IOWA DOT

HOT MIX ASPHALT SAMPLING TECHNICIAN

INSTRUCTION MANUAL

2023-2024

TECHNICAL TRAINING AND CERTIFICATION PROGRAM

HMA SAMPLER INSTRUCTION MANUAL

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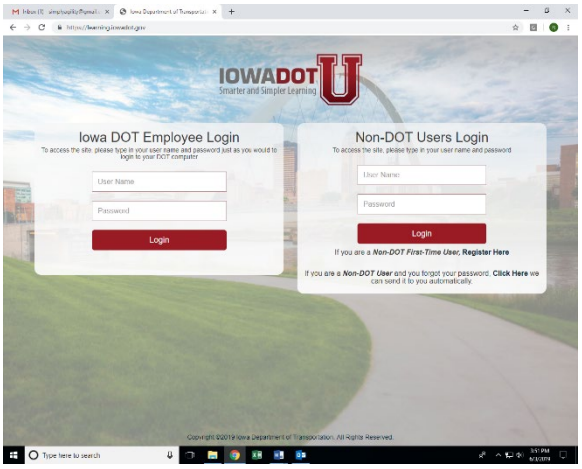
WEBSITES USED IN TTCP CLASSES

There are 2 websites you will use as a TTCP Student. You will set yourself up as a user of each of these websites. It's important that you remember your user name and password for each site (hint: since you are setting each of them up yourself, you could use the same password for each site.)

IOWADOTU

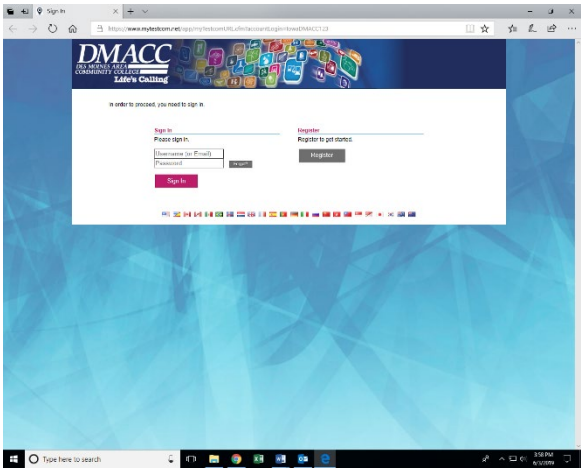
https://learning.iowadot.gov/

This is where you register for classes and take web-based training. You can also print your training records transcripts here. Step-by-step instructions are available at https://iowadot.gov/training/technical-training-and-certification-program



COMPUTER TESTING

All TTCP Exams will be done on the computer. Your instructor will guide you to the Test.Com website and assist with any registration requirements. Questions are multiple choice, and you will be able to see your score immediately as well as the questions that you missed.



INTRODUCTION

HOT MIX ASPHALT (HMA) SAMPLING TECHNICIAN INSPECTION DUTIES

Duties of the Hot Mix Asphalt Sampling Technician consist of, but are not limited to the following:

A. Plant Sampling. (Article 2303.04, IM 204 & 511)

1. Obtain asphalt binder samples as directed by Contracting Authority personnel per IM 323 and IM 204.

B. Field Sampling (Article 2303.04, IM 204 & 511)

1. Obtain uncompacted mix random samples as directed by Contracting Authority personnel, and identify time, station, lift and side.

2. Obtain compacted mix core random samples as directed by Contracting Authority personnel.

FEDERAL CODE 1020 and IOWA CODE 714.8

I.M. 213 discusses the Unsatisfactory Notice that Certified Technicians are given when they are not performing their job duties satisfactorily. This can be given for a number of reasons including, improper sampling and/or testing, not performing their duties and reporting in the time frame required, reporting incorrect information, etc. The technician is given one written notice, the second notice is three-month certification suspension, and the third notice is decertification. According to I.M. 213 the Certified Technician can automatically be decertified for false statements without going through the Unsatisfactory Notice procedure. The Certified Technician also needs to be aware of the false statement clause that is applicable to all federal-aid projects and the fraudulent practice clause that applies to all non-federal aid projects. **Certified Technicians need to read and be aware of U.S.C. 1020 and Iowa Code 714.8 since these do apply to them.** They read as follows:

FEDERAL AID PROJECTS

IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, the following notice shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

NOTICE TO ALL PERSONNEL ENGAGED ON FEDERAL-AID HIGHWAY PROJECTS
18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined not more than $10,000 or imprisoned not more than 5 years or both"

NON-FEDERAL AID PROJECTS

Iowa Code 714.8, subsection 3, defines fraudulent practices. "A person who does any of the following acts is guilty of a fraudulent practice. Subsection 3, Knowingly executes or tenders a false certification under penalty of perjury, false affidavit, or false certificate, if the certification, affidavit, or certificate is required by law or given in support of a claim for compensation, indemnification, restitution, or other payment." Depending on the amount of money claimed for payment, this could be a Class C or Class D felony, with potential fines and/or prison.

The above codes refer to the individual making the false statement. **Standard Specification Article 1102.03, paragraph C. section 5 refers to the Contractor.**

Article 1102.03, paragraph C, section 5 states, "A contractor may be disqualified from bidder qualification if or when: The contractor has falsified documents or certifications, or has knowingly provided false information to the Department or the Contracting Authority."

******THIS IS A NEW IM. – PLEASE READ CAREFULLY.******

ASPHALTIC TERMINOLOGY

SCOPE

This IM describes the terminology associated with asphaltic materials.

LIQUID ASPHALT TERMINOLOGY

Asphalt Cement – See **Binder**

Binder – A dark brown to black cementitious material, which occurs in nature or is obtained in petroleum processing. Also commonly referred to Asphalt Cement (AC).

Bitumen – See **Binder**

Cutback Asphalt – Liquid asphalt composed of asphalt binder and a petroleum solvent. Cutback asphalts have three types (Rapid Curing (RC), Medium Curing (MC), and Slow Curing (SC)). The petroleum solvent, also called diluents, can have high volatility (RC) to low volatility (SC).

Emulsified Asphalt – Composed of asphalt binder and water, and a small quantity of emulsifying agent, which is similar to detergent. They may be of either the Anionic, electro-negatively-charged asphalt globules, or Cationic, electro-positively-charged asphalt globules types, depending upon the emulsifying agent. Emulsified asphalt is produced in three grades (Rapid-Setting (RS), Medium-Setting (MS), and Slow-Setting (SS)).

Flux or Flux Oil – A thick, relatively nonvolatile fraction of petroleum, which may be used to soften asphalt binder to a desired consistency.

Foamed Asphalt – A combination of high temperature asphalt binder and water to produce foaming.

Gilsonite – A form of natural asphalt, hard and brittle, which is mined.

Modified Binder – These are asphalt binders, which have been physically- and/or chemically-altered (usually with an additive) to bring the characteristics of the binder to what is desired for the application. This process includes polymer modification.

Performance Graded Asphalt (PG) – The identification associated with the grading of the binder. Prior identification methods have been penetration and viscosity grading. For example, a PG 64-22 would indicate a performance-graded binder with a high temperature confidence of 64°C and a low temperature confidence of -22°C.

Viscosity – The property of a fluid or semifluid that enables it to resist flow. The higher the viscosity, the greater the resistance to flow.

AGGREGATE TERMINOLOGY

Absorption – The property of an aggregate particle to take in and hold a fluid. For our purposes usually asphalt binder or water.

Aggregate – Any hard, inert, mineral material used for mixing in graduated fragments. It includes sand, gravel, crushed stone, and slag.

Coarse Aggregate – The aggregate particles retained on the #4 (4.75 mm) sieve.

Coarse-Graded Aggregate – A blend of aggregate particles having a continuous grading in sizes of particles from coarse through fine with a predominance of coarse sizes. A gradation below the maximum density line.

Cold-Feed Gradation – The aggregate proportioning system employing calibrated bins to deliver aggregate to the dryer (see IM 508 for additional information).

Fine Aggregate – Aggregate particles passing the #4 (4.75 mm) sieve.

Fine-Graded Aggregate – A blend of aggregate particles having a continuous grading in sizes of particles from coarse through fine with a predominance of fine sizes. A gradation above the maximum density line.

Gradation – The description given to the proportions of aggregate on a series of sieves. Usually defined in terms of the % passing successive sieve sizes.

Lime – A product used to enhance the bond between aggregate and asphalt binder. It is composed of dust from crushed limestone. Hydrated lime is often specified for surface mixes.

Manufactured Sand –The predominately minus #4 (4.75 mm) material produced from crushing ledge rock or gravel.

Mineral Filler – A finely divided mineral product at least 70 percent of which will pass a #200 (75 µm) sieve. Pulverized limestone is the most commonly manufactured filler, although other stone dust, hydrated lime, Portland cement, fly ash and certain natural deposits of finely divided mineral matter are also used.

Natural Sand – A loose, granular material found in natural deposits.

Open-Graded Aggregate – A blend of aggregate particles containing little or no fine aggregate and mineral filler and the void spaces in the compacted aggregate are relatively large.

Slag – A byproduct of steel production.

Well-Graded Aggregate – Aggregate that is uniformly graded from coarse to fine.

MIX TERMINOLOGY

Asphalt Cement Concrete – See **Hot Mix Asphalt**

Asphalt Leveling Course – Lift(s) of HMA of variable thickness used to eliminate irregularities in the contour of an existing surface prior to overlay.

Asphalt Overlay – One or more lifts of HMA constructed on an existing pavement. The overlay may include a leveling course to correct the contour of the old pavement, followed by uniform course or courses to provide needed thickness.

Base Course – Lift(s) of HMA pavement placed on the subgrade or subbase on which successive layers are placed.

Binder Course – See **Intermediate Course**

Full-Depth® Asphalt Pavement – The term Full-Depth® certifies that the pavement is one in which asphalt mixtures are employed for all courses above the subgrade or improved subgrade. A Full-Depth® asphalt pavement is laid directly on the prepared subgrade.

Hot Mix Asphalt (HMA) – Asphalt binder/aggregate mixture produced at a batch or drum-mixing facility that must be spread and compacted while at an elevated temperature. To dry the aggregate and obtain sufficient fluidity of the binder, both must be heated prior to mixing – giving origin to the term “hot mix.”

Intermediate Course – An HMA pavement course between a base course and a surface course.

Job Mix Formula (JMF) – The JMF is the mix design used to begin a HMA project. It is also used as the basis for the control of plant produced mixture. It sets the proportions of the aggregate and amount of asphalt binder.

Mixed-In-Place (Road Mix) – An HMA course produced by mixing mineral aggregate and cutback or emulsified asphalt at the road site by means of travel plants, motor graders, or special road-mixing equipment.

Plant Mix – A mixture, produced in an asphalt mixing facility that consists of mineral aggregate uniformly coated with asphalt binder, emulsified asphalt or cutback asphalt.

Sand Asphalt – A mixture of sand and asphalt binder, cutback or emulsified asphalt. It may be prepared with or without special control of aggregate grading and may or may not contain mineral filler. Either mixed-in-place or plant-mix construction may be employed.

Sheet Asphalt – A hot mixture of binder with clean angular, graded sand and mineral filler.

Surface Course – The top lift(s) of HMA pavement, sometimes called asphalt wearing course.

Warm-Mix Asphalt (WMA) – Similar to HMA but produced by using additives that allow the mix to be produced, placed and compacted at lower temperatures.

MISCELLANEOUS TERMINOLOGY

Asphalt Joint Sealer – An asphalt product used for sealing cracks and joints in pavements and other structures.

Average Absolute Deviation (AAD) – The absolute value of the difference of a test result from a specified value, averaged for a specified set of values.

Cold-In-Place Recycling – A method of rehabilitating the HMA surface by milling, adding a stabilizing agent, relaying and compacting in a continuous operation (see IM 504 for additional information).

Durability – The property of an asphalt paving mixture that describes its ability to resist the detrimental effects of air, water and temperature. Included under weathering are changes in the characteristics of asphalt, such as oxidation and volatilization, and changes in the pavement and aggregate due to the action of water, including freezing and thawing.

Fatigue Resistance – The ability of asphalt pavement to withstand repeated flexing caused by the passage of wheel loads.

Field Density – The density ($G_{mb\ (field)}$) of HMA based on field roller compaction.

Field Voids – The percent by volume of air voids in cores cut from the finished pavement.

Flexibility – The ability of an asphalt paving mixture to be able to bend slightly, without cracking, and to conform to gradual settlements and movements of the base and subgrade.

Fog Seal – A light application of emulsion diluted with water that is applied without mineral aggregate cover.

Lab Density – The density ($G_{mb\ (lab)}$) of HMA based on laboratory compaction.

Lab Voids – The percent by volume of air voids in laboratory compacted specimens.

Pay Factor – A calculated multiplier used to determine adjustments to payment to the contractor. Pay factors greater than 1.000 are referred to as “incentive” and pay factors less than 1.000 are referred to as “disincentive” or “penalties”

Percent Within Limits (PWL) – A statistical estimation of the percentage of a material that falls between specified limits based on sampling and testing of the material. PWL is used to calculate the pay factor.

Permeability – The resistance that an asphalt pavement has to the passage of air and water into or through the pavement.

Recycled Asphalt Pavement (RAP) – HMA removed and processed, generally by milling. This material may be stored and used in mixtures in addition to virgin aggregate and binder. This is also referred to as Reclaimed Asphalt Pavement.

Recycled Asphalt Shingles (RAS) – Roofing shingles, either waste from a shingle manufacturer or tear off shingles from reroofing operations. Shingles contain a high percentage of asphalt as well as fibers and fine aggregate. Shingles are processed into a fine material and handled similar to RAP.

Seal Coat – A thin asphalt surface treatment used to waterproof and improve the texture of an asphalt wearing surface. Depending on the purpose, seal coats may or may not be covered with aggregate. The main types of seal coats are aggregate seals, fog seals, emulsion slurry seals and sand seals.

Skid Resistance – The ability of asphalt paving surface, particularly when wet, to offer friction against the tire surface.

Slurry Seal – A mixture of emulsified asphalt, fine aggregate and mineral filler, with water added to produce flowing consistency.

Specific Gravity – The weight to volume relationship of material in relation to water.

Stability – The ability of asphalt paving mixtures to resist deformation from imposed loads. Unstable pavements are marked by channeling (ruts), and corrugations (washboarding).

Surface Treatments – A broad term embracing several types of asphalt or asphalt-aggregate applications, usually less than 1 in. (25 mm) thick, to a road surface. The types range from a light application of emulsified or cutback asphalt (Fog seal) to a single or multiple surface layers made up of alternating applications of asphalt and aggregate (chip seal).

Tack Coat – A very light application of asphalt, usually asphalt emulsion diluted with water. It is used to ensure a bond between the existing pavement surface and the overlay.

CONSTRUCTION TERMINOLOGY

Batch Plant – This type of HMA production plant is used to produce individual batches of mix by making use of a pugmill (see IM 508 for additional information).

Certified Plant Inspection (CPI) – A specified method of quality control using a Certified Plant Inspector (see Section 2521 of the Standard Specification for additional information).

Cold-Feed – The device used to combine the various aggregates, in the correct proportions.

Drum Plant – This type of HMA production plant is a continuously operating plant, which mixes the aggregate, asphalt binder and RAP (if used) in the drum (See IM 508 for additional information).

Quality Management of Asphalt (QMA) – A specified quality control procedure where the contractor is responsible for the mix design and the control of the mix properties during production (see IM 511 for additional information). The agency is responsible for quality assurance and verification.

Workability – The ease with which paving mixtures may be placed and compacted.

4. Sampling and Testing.

a. General.

1) Perform sampling and testing to provide the quality control of the mixture during plant production. Certified Plant Inspection according to Section 2521 is required.

2) Personnel involved in sampling and testing on both verification and quality control shall be Iowa DOT certified for the duties performed per Materials I.M. 213.

3) Provide easy and safe access for Iowa DOT staff to the location in the plant where samples are taken.

4) Maintain and calibrate the quality control testing equipment using prescribed procedures. Sample and test according to the specified procedures as listed in the applicable Materials I.M. and Specifications. When the results from a Contractor's quality control lab are used as part of product acceptance, the Contractor's quality control lab is required to be qualified.

5) Identify, store, and retain all quality control samples and field lab gyratory specimens used for acceptance until the lot is accepted.

6) Obtain verification samples at random times as directed and witnessed by the Engineer according to Materials I.M. 204 Appendix F. Secure all verification samples according to Materials I.M. 205 Appendix A. Store verification samples for the Contracting Authority until delivery to the Contracting Authority's lab.

7) Deliver the Plant Report to the Engineer and the designated district materials laboratory daily. At project completion, provide the Engineer a copy of the reports, charts, and other electronic file(s) containing project information generated during the progress of the work.

b. Asphalt Binder.

Sample and test asphalt binder to verify the quality of the binder grade. Do not sample when daily production is less than 100 tons of mixture.

c. Tack Material.

Sample and test asphalt emulsions to verify residual asphalt content.

d. Aggregate Gradation.

1) Use cold feed or ignition oven gradation for aggregate gradation control to assure materials are being proportioned according to the specifications.

2) Take a minimum of one aggregate gradation for each day's production that exceeds 100 tons of mixture. When more than one sample in a day's production is tested, use the average gradation to determine compliance of the daily lot.

3) Engineer will verify Contractor gradation with an ignition oven or a split cold feed sample. For ignition oven validation, split a cold feed sample with the Engineer to determine the need for a correction factor according to Materials I.M. 511. The Engineer may require additional cold feed split samples.

e. Uncompacted Asphalt Mixture.

1) Sample the loose mixture according to Materials I.M. 322.

2) Modify sampling location to include placement with mix stored from a previous day's production.

3) The number of daily samples is defined in Table 2303.03-5 based on the day's estimated production. See Materials I.M. 511 for determining sample locations.

Table 2303.03-5: Uncompacted Mixture Sampling

Estimated Daily Production, Tons	Number of Samples
101-500	1
501-1250	2
1251-2000	3
2001-4500	4
Over 4500	5

4) Do not take samples from the first 100 tons of mix produced each day or the first 100 tons of mix following a significant mix change. When paving operations are staged so each day of placement is less than 100 tons for the entire production of the bid item, establish a sampling plan with the Engineer that includes a minimum of one sample per 2500 tons.
5) Split samples for specimen preparation according to Materials I.M. 357.
6) Paired sampling may also be accomplished by taking a bulk sample and immediately splitting the sample according to Materials I.M. 322 on the grade.
7) Test the quality control sample of each production paired sample as follows:
   a) Prepare and compact two gyratory specimens according to Materials I.M. 325G.
   b) Determine the bulk specific gravity of compacted mixture (G_{mb}) at N_{design} for each specimen according to Materials I.M. 321. Average the results.
   c) Determine the Theoretical Maximum Specific Gravity (G_{mm}) of the uncompacted mixture according to Materials I.M. 350.
   d) Determine laboratory air voids for each sample according to Materials I.M. 501.Use the target laboratory voids listed in Materials I.M. 510 Appendix A unless otherwise specified in the contract documents.

f. Compacted Pavement Cores.

1) The Engineer will determine the core locations. The length laid in each lot will be divided into approximately equal sublots. Obtain one sample at a random location in each sublot. Determine a new random location for the sublot when the designated core location falls on a runout taper at an existing pavement, bridge, or bridge approach section where the thickness is less than the design thickness.
2) Take samples from the compacted mixture and test no later than the next working day following placement and compaction.
3) Restore the surfaces the same day. Dry, fill with the same material, and properly compact core holes.
4) Pavement core samples will be identified, taken possession of by the Engineer, and delivered to the Contractor's quality control field laboratory.
5) The Engineer may either:
   - Transport the cores directly to the lab, or
   - Secure the cores and allow the Contractor to transport the cores to the lab.
6) Prepare and test the cores according to Materials I.M. 320, 321, and 337.
7) Cut and trim samples under the direction of and witnessed by the Engineer for tests of G_{mb}, thickness, or composition by using a power driven masonry saw.
8) The compacted HMA pavement will be tested in a timely manner by the Engineer's personnel. The Engineer will test each lot of cores at the Contractor's field quality control laboratory. Cores may also be tested by the Contractor; however, the Contractor's test results will not be used for material acceptance.

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE & RELATED IMs	QUALITY CONTROL					INDEPENDENT ASSURANCE, & VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates-Coarse (4127)		AS 209												
Aggregates-Fine (4127)		AS 209												
Hydrated Lime (4127)		AS 491.04												
Asphalt Binder		AS 437												
Emulsions & Cutbacks		AS 437												
Release Agent		AB 491.15												
Recycled Asphalt Shingles		AS 506												
PLANT INSPECTION														
Aggregates (2303)	Quality							V	DME	1/20,000 Ton	50 lb.	CTRL		
Combined Aggregate (4127)	Gradation	302, 306, 336	RCE/ CONTR	1/lot	IM 301	CONTR		V IA	RCE/ CONTR	Sample 1/day, Test 1st day + 20% Systems Approach*	IM 301	DME/ RCE	IM 216 IM 216	
	Moisture		CONTR	1 / half day	1000 gm	CONTR								Drum Mix Plants Only
Asphalt Binder	DSR Quality	AS Cert 323						V V IA	RCE/ CONTR DME	Sample 1/day Test 1st 1/week 1/20,000 T of Mix Systems Approach	4 oz tin 1 qt	DME CTRL		Log all shipments ** Interlayer
Cutback		AS Cert												Log all shipments
Emulsion	Residue	AS 360						V	RCE	1/project	1 qt	DME		Plastic bottle required

AB-Approved Brand
AS-Approved Source
ASD-Approved Shop Drawing
S&T-Sampling & Testing
Cert- Certification Statement
CONTR-Contractor
RCE-Resident Construction Engineer/Project Engineer
DME-District Materials Engineer
CTRL-Central Laboratory
IA-Independent Assurance
V-Verification

*A project approach may be applied at the discretion of the DME at the frequency 1/project.

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE & RELATED IMs	QUALITY CONTROL					INDEPENDENT ASSURANCE, & VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Uncompacted Mixture:	Lab Density & Lab Voids	321,322, 350 325G, 357, 338	RCE/ CONTR	As per 2303	40 lb	CONTR		V IA	RCE/ CONTR	As per 2303 Test 1/day Systems Approach	40 lb	DME		***Interlayer
	Moisture Sensitivity	319, 322, 325G Article 2303.02, E.2						V	RCE/ CONTR	Test 1st Sample at 500 tons then sample 1/10,000 tons per 2303 until 1st sample accepted (test as needed)	70 lb	CTRL		
Compacted Mixture	Mat Density, Thickness & Voids	320, 321 337						V IA	RCE/ CONTR DME	Lot 1 lot/project*	Min 8/lot	RCE DME		
	Joint Density	SS-15004 Or DS-15036						V	RCE/ CONTR	Lot	3/lot	RCE		6-inch core
	Smoothness	341	CONTR	100%	100%	CONTR		V	DME	10%		DME		

AB-Approved Brand
AS-Approved Source
ASD-Approved Shop Drawing
S&T-Sampling & Testing

Cert- Certification Statement

CONTR-Contractor
RCE-Resident Construction Engineer/Project Engineer
DME-District Materials Engineer
CTRL-Central Laboratory

IA-Independent Assurance
V-Verification

*** A system approach may be applied at the discretion of the DME.**
NOTE: A Verification sample for asphalt binder quality and aggregate quality not required under 2000 tons of mix.
NOTE: RCE/CONTR indicates that the Contractor shall assist in the sampling at the direction of and witnessed by the Project Engineer.
****NOTE: For interlayer construction, as a minimum, sample 1 Qt. each day, and perform the MSCR test on the first and last day's binder sample of interlayer placement.**
***** NOTE: For interlayer construction, in addition to the required uncompacted mix sample(s) tested by the contractor and district lab, sample and retain at least one additional box of uncompacted mix each day of interlayer placement.**
NOTE: For Local agency projects with no Federal Funds Independent Assurance, IA, tests are not required.
NOTE: For Local agency projects with no Federal funding, verification samples or monitor samples sampled by the DME are not required. These samples may be sampled by the contracting authority. With prior approval, these samples may be tested by the Iowa Department of Transportation Central Laboratory.
NOTE: For Local agency projects with no Federal funding, smoothness verification testing may be tested and evaluated by the DME.

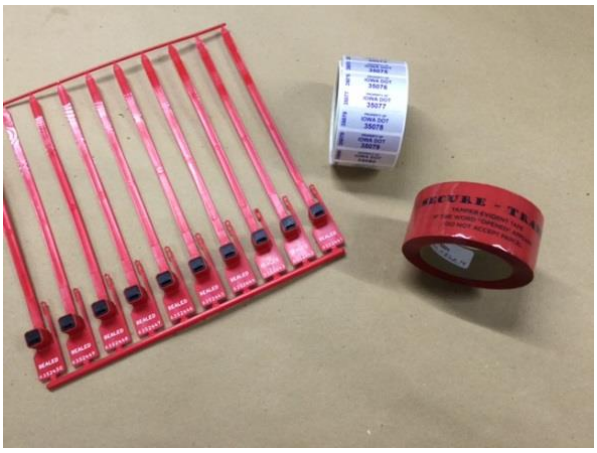
SECURING SAMPLES

INTRODUCTION

This IM is intended to provide instructions on how to secure verification samples. Verification samples can be transported by the contracting authority without additional security measures. Verification samples not transported by the contracting authority must make use of the following procedures unless directed otherwise by the District Materials Engineer (DME). For materials not able to be secured through one of the following methods, contact your local DME for additional guidance.

PROCEDURES

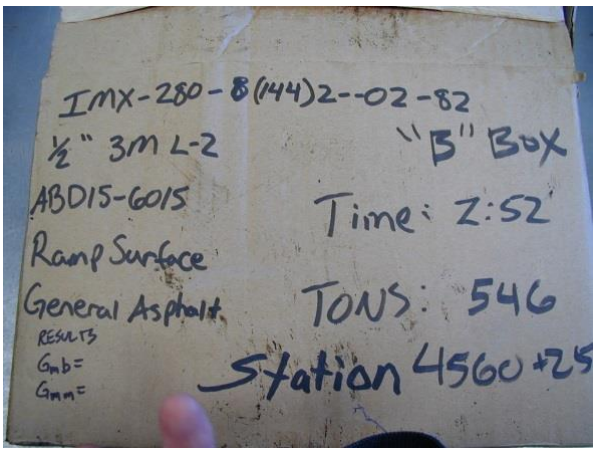
To obtain the required security supplies, contact your local District Materials Office. These are examples of the security supplies available.



TAMPER PROOF TAPES

Tamper proof tapes can be used to secure boxes, binder tins, and other similar containers.

Here are some examples of how the tamper proof tape can be utilized.



Standard practice is to place the 193 form inside the box prior to securing the box. For loose asphalt mix, on the outside of the box several pieces of information are recorded including the date, mix design number, sender's number, project number and sample number.

When using the numbered security tape the number is recorded on the 193. The paper 193 (if used) must accompany the sample. The secured binder tin should be placed inside the secured cold feed bag. Should an ignition oven sample be utilized to determine gradation compliance, the secured binder tin may be placed inside the secured box of loose mix. The secured binder tin may be placed inside the box of loose mix.

TAMPER PROOF TAGS

Tamper proof tags are used to secure bags. Examples of the tamper proof tags and how they are applied to the bags are as follows:

The security number on the tag is recorded on the 193 form and the paper 193 (if used) placed inside the bag prior securing the bag for delivery.

DOCUMENTATION

The identification number on the tamper proof tag is recorded on the 193 form and the paper 193 (if used) is then secured with the sample prior to submitting to the District Materials Office. Arrangements can be made to submit the 193s electronically with notification to the DME.

SAMPLING MATERIALS AT A HOT MIX ASPHALT PLANT					
WHO	WHAT	WHERE	WHEN	HOW	SECURITY
is involved?	is sampled?	is the sample taken?	how often?	explain	what type?
	BINDER				
	TACK				
	UNCOMPACTED				
	HMA				
	COMPACTED				
	HMA				

ASPHALT
BINDER

ASPHALT BINDER SAMPLING AT THE PLANT

Asphalt Binder is required to be sampled at the plant by the Contractor. The sample is then submitted to the Iowa DOT so that tests can be run to verify the PG Binder Grade.

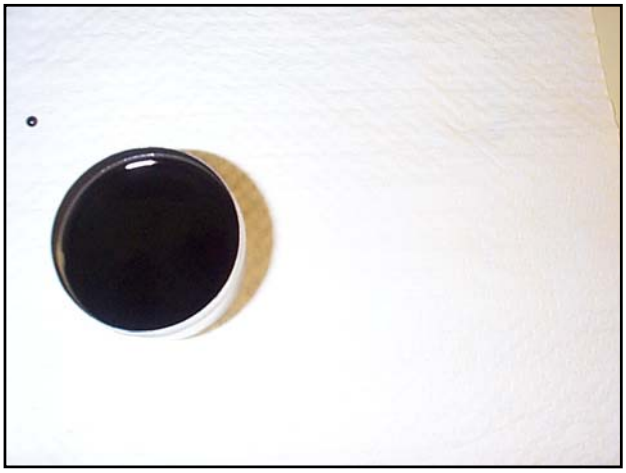
Asphalt Binder samples need to be representative of the binder being incorporated into the mix. It must be taken from sampling valves located in the pumping line, between the storage tank and the mixer. For quality control, samples cannot be taken from the delivery tanker.

It's very important that the sampling location is accessible and safe. A poor setup is an accident waiting to happen. It is important to wear proper safety apparel to prevent burns from spills or "burps" in the line.

Care should be taken to ensure the sample is not contaminated.

IM 323 explains the proper sampling procedure for Asphalt Binder.

*This sample must be directed and witnessed by the Agency's Inspector. The contractor can take as many samples as they'd like for their own Quality Control, but only the directed and witnessed samples are used for Acceptance. The Agency's Inspector will supply the security items and complete the Form 193.




SUPPLY CO.
WEST DES MOINES, IOWA
18
THIS VEHICLE
RM 6991

IOWADOT
Form 820193
(03-17)

Highway Division
Office of Construction and Materials
Ames, Iowa

Central
Lab No.: _____

IDENTIFICATION OF SAMPLE TEST

Material: Asphalt Binder PG58-28V

Barcode Security ID No.: D1-000101

Intended Use: HMA VT Surface

Sender's Sample No.: BIN10-25A

County: POLK

Contract ID No.: 77-0355-097

Project: IMX-35-5(97)121--02-77

Mix Design No.: ABD23-1045

Contractor: Quality Asphalt Inc. (Name) _____ (Address)

Supplier: Texpar Energy LLC

Source: Texpar Davenport

Producer: Texpar Davenport

Brand: PG58-28V

Lot No./Heat No.: _____

Location of Producing Plant: Texpar Davenport

Quantity Represented: One 4oz tin per days run

Sample by: John Rayson witnessed by Bob Anderson (Name) _____ (Address)

Date Sampled: 10-25-2023

Date Received: _____

Report to District Materials *[Check appropriate box(es)]*

Dist 1	Dist 2	Dist 3	Dist 4	Dist 5	Dist 6
☒	☐	☐	☐	☐	☐

Report to Residency *(Write appropriate residency number)* ☐☐ ☐☐ ☐☐ ☐☐ ☐☐

(Last two digits of Cost Center)

Report to Counties *(Write appropriate county number)* ☐☐ ☐☐ ☐☐ ☐☐ ☐☐

Report to Other: Quality Asphalt Inc.

Report to Other: _____

Report to Other: _____

Results need by: Date: ASAP

Additional Detailed information:

Check Sample Type	
☐ V	Verification
☒ PN	Project Information
☐ MD	Mix Design
☐ DI	Dept. Information
☐ WH	Warehouse Stock
☐ IA	Independent Assurance

(NOTE: A representative of the Department of Transportation shall select the sample.)

Distribution: One copy - with the sample; One copy - File

METHOD OF SAMPLING ASPHALTIC MATERIALS

SCOPE

This IM provides the procedure used in the sampling of asphaltic materials (asphalt binder, asphalt emulsions, and cutback asphalts) to be submitted for laboratory tests. The necessary sample containers are available for purchase by the contractor from the Iowa Department of Transportation, Ames warehouse.

APPARATUS

- Disposable, unlined, one-quart capacity cardboard sample catching containers.
- 3 oz. or 4 oz. ointment tin for asphalt binder.
- One-quart capacity wide-mouth cans with lids for cutback asphalts and complete analysis binder samples.
- One-quart and one gallon plastic bottles for asphalt emulsion.
- Clean, dry cloth.
- 1 pair insulated gloves.

PROCEDURE

1. Single samples as follows:

   a. Binder for DSR stiffness – 3 oz. or 4 oz. tin

   b. Binder complete analysis – 1 quart metal can

   c. Cutback asphalts – 1 quart metal can

   d. Asphalt emulsion – partial analysis 1 quart– must be a plastic bottle
   – complete analysis – 1 gallon– must be a plastic bottle

SAMPLING PROCEDURE

The various materials shall be drawn from plants, distributors, and storage tanks as required in a safe and reliable manner. Single samples shall be taken at the rate prescribed and by the following methods:

1. Sampling from Mixing Plants

   Samples shall be taken from sampling valves located in the pumping line, (line from tank to mixer). A minimum of one-gallon of material must be drawn and wasted from the sampling valve before the actual sample is drawn. The plant should be operated a minimum of one hour before samples are taken.

Sample material shall be drawn into the appropriate containers provided for that purpose. DSR samples shall be prepared by pouring the material from the sample catching container into the ointment tins; the tins shall be filled to a depth 1/4" from the top. Material should not be spilled over the sides and edges of the tins. The tins should be covered and allowed to cool in air to handling temperature. The tins should then be capped and marked for shipment. When cutback asphalt or asphalt emulsion samples are obtained from mixing plants, the sample shall be one quart or one gallon size and may be placed directly in the shipping containers provided.

Prior to use, the "uncoated" sample-catching containers and sample storage containers should be inspected and wiped clean of dust and manufacturing residue with a clean, dry cloth. If the containers, which are to be used for shipment, are spattered during the pouring operation, they should be wiped clean with a clean, dry cloth. In case the tins are over filled or otherwise made unusable, they should be disposed of and new tins filled as required. Under no circumstances should any volatile material or contaminants of any kind be allowed to come in contact with the samples, containers, and cleaning cloths.

In the event that it is necessary to sample storage tanks by dipping through the dome or top opening of a tank, care should be taken so that the container is not filled entirely with the materials from the top portion of material in storage.

2. Samples from Distributors

Samples should be drawn from the spray bar after heating and recirculation has been completed. The spray bar should be opened and cleared of old or foreign material before the sample is taken. Asphalt emulsion samples should be taken from the spray bar after it has been adjusted to gravity feed. Samples may be drawn directly into sample containers furnished for this purpose.

> **NOTE:**: The test results of asphalt emulsion samples can be greatly affected when samples are obtained from the spray bar, under pressure.
>
> **NOTE:** When asphalt emulsions are diluted for tack coat material, the addition of the water changes the manufacturer's formula. Due to this, very rapid settlement occurs. To obtain a representative sample of the diluted asphalt emulsion, it is essential to obtain the sample immediately after circulating the material.

The precautions listed in the previous section should be observed in this procedure as well. Refer to Section No. 1 for size of samples.

3. Samples from Transports, Rail Cars, Terminal Storage

When samples are to be obtained from hauling units or terminal facilities, sampling methods listed in Section No. 1 above are to apply. Samples shall be drawn from sampling valves located in tank walls or bulkhead, and/or transfer lines when possible. When sampling

valves are not provided, samples are to be obtained by inverting sample containers substantially below the surface of the stored material.

UNCOMPACTED
HMA

UNCOMPACTED MIX SAMPLING

IM 322 requires HMA and WMA mixtures to be sampled at the grade for testing to determine laboratory air voids and possibly aggregate gradation. For ST, HT, and VT mixtures placed by a paver, it is usually sampled from the last point in the construction process, after it's been placed and before it's been rolled. Special circumstances and special mixtures such as the High Performance Thin Lift (HiPro) and the Interlayer allow other sampling methods. Sampling from the windrow in front of the paver or from the paver hopper is required for the special mixtures. The DME may approve windrow sampling for special circumstances. When placing mix in a widening trench or other circumstances where the thickness is greater than three inches, a square point shovel may be used to sample. It must be a representative sample of the mix being placed.

Proper safety precautions must be taken. Gloves, work boots, eye protection, vests and hard hats are required. Make sure you use proper safety procedures and are aware of the construction traffic and travelling public while on the grade.

The number of hot mix asphalt samples needed each day is based on the tonnage being produced. The sampling rate is 1 / sublot and the number of sublots can be found in the Specifications.

Table 2303.03-5: Uncompacted Mixture Sampling

Estimated Daily Production, Tons	Number of Samples
101-500	1
501-1250	2
1251-2000	3
2001-4500	4
Over 4500	5

The Agency technician will determine the location within each sublot by using the random number generator spreadsheet provided by the Iowa DOT. This can be found at: http://www.iowadot.gov/Construction_Materials/hma.html

IM 322 explains the proper sampling procedure for hot mix asphalt. Do not vary from this procedure unless directed to do so, and if you do vary, document why and how. **The technician CANNOT vary from the IM unless directed to do so by the DME. This includes windrow sampling.**

*This sample must be directed and witnessed by the Agency's Inspector. The contractor can take as many samples as they'd like for their own Quality Control, but only the directed and witnessed samples are used for Acceptance. The Agency's Inspector will supply the security items and complete the Form 193.

Date:	10/26/2012			
Expected Tons Produced For The Day:	4,900.00			
First Hot Box Sample Tons:	281.00	–	980.00	First Sublot (tons):
Second Hot Box Sample Tons:	1,114.00	–	980.00	Second Sublot (tons)
Third Hot Box Sample Tons:	2,257.00	–	980.00	Third Sublot (tons)
Fourth Hot Box Sample Tons:	3,147.00	–	980.00	Fourth Sublot (tons)
Fifth Hot Box Sample Tons:	4,860.00	–	980.00	Fifth Sublot (tons)

Approved Increased Sampling Plan based on Today's Production	# of Sublots

Production, tons			# of Sublots
101	to	500	1
501	to	1250	2
1251	to	2000	3
2001	to	4500	4
>		4500	5

Expected tons from Silo storage

Plant Production Tons per Hour:	450
Laydown Start Time:	7:00 AM
Approximate First Sample Time:	7:37 AM
Approximate Second Sample Time:	9:28 AM
Approximate Third Sample Time:	12:00 PM
Approximate Fourth Sample Time:	1:59 PM
Approximate Fifth Sample Time:	5:48 PM

Press F9 to Calculate

To use this spreadsheet to select random samples of uncompacted HMA you must provide the tonnage the contractor expects to lay.
If only the expected tonnage is provided the program will provide sample locations based on the running total of tonnage delivered when you press F9.
If you want the sample locations expressed as time you must also provide the tons per hour at which the plant is operating and the time when the laydown operation started then press F9.

Any changes in expected tonnage or plant production such as breakdowns, weather interruptions or other delays may require recalculation of sample locations if the interrruption causes the sample time to fall during a period when no mix is being laid or fall in the same sublot as a previous sample.

Every attempt should be made to keep the sampling random, however if, for example, rain-out is eminent or plant production ceases prematurely and the sample for the sublot has not been obtained a sample should be taken immediately if possible.

Sample locations must not be provided to the contractor in advance except for the time needed to prepare for sampling.
The contractor should be prepared to sample as directed at any time.

This program works best if it is the only file loaded in Excel. Automatic recalculation has been turned off in this file so that the program will only calculate once when you press F9.
If other files have been loaded into Excel that allow automatic recalculation this file may change sample locations whenever any data is changed.
If this occurs, exit Excel then reload it and open this file and complete the sample locations before loading any other Excel files.

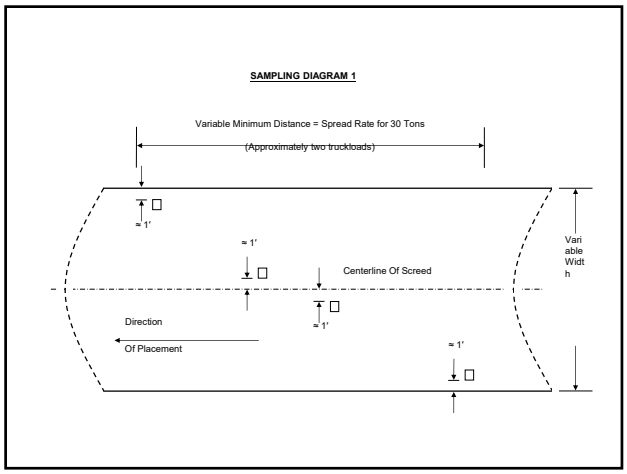
Hot Mix Asphalt Sampling

- Paired Samples, one box for the Contractor, one for the Agency, each containing at least 40 Lbs.
- Can use a single template, or a double template
  - The use of a double template can speed up the sampling since it requires only one placement for each increment.
  - If using a double template, you can eliminate scraping the template between each increment if you pair the samples correctly

1

2

3


SAMPLING DIAGRAM 1
Variable Minimum Distance = Spread Rate for 30 Tons
(Approximately two truckloads)
≈ 1'
≈ 1'
Centerline Of Screed
≈ 1'
Direction
Of Placement
≈ 1'
Vari
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Widt
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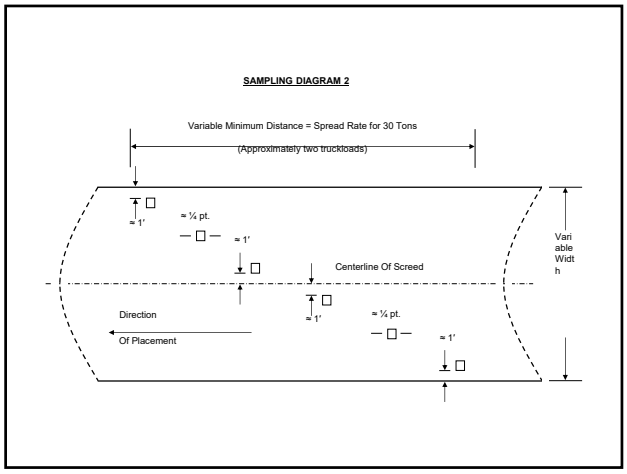
4


SAMPLING DIAGRAM 2
Variable Minimum Distance = Spread Rate for 30 Tons
(Approximately two truckloads)
≈ 1'
≈ ¼ pt.
≈ 1'
Centerline Of Screed
≈ 1'
Direction
Of Placement
≈ ¼ pt.
≈ 1'
Vari
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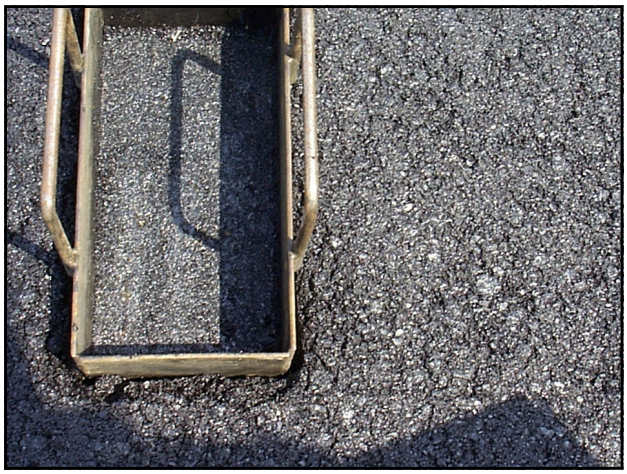
8

9



10

11

12

13

Thick Lifts greater than 3” can be sampled using a square point shovel instead of the template. Use the shovel to delineate an area and carefully remove all material from within the area.

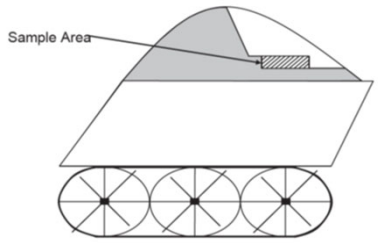
14

Sampling from Hopper

- Sampling of special mixes like High Performance Thin Lift and Interlayer is not performed behind the paver due to the high polymer content of the binder. One of the methods specified for these mixes is sampling from the paver hopper.

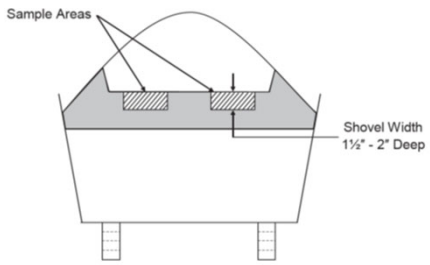
15

Sampling from Hopper



16

Sampling from Hopper



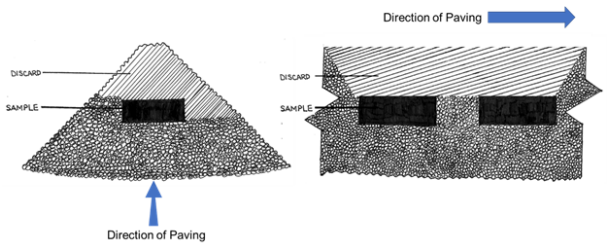
17

Sampling from Windrow

- The other method used for sampling special mixes is to obtain samples from the windrow if the contractor is using that method of placement.
- Windrow sampling may also be used for standard mixes with the approval of the DME.

18

Sampling from Windrow



19

20

SAMPLE IDENTIFICATION

Sampling identification is very important. The box that is sent to the agency must have all the necessary information written on it. The Sample Identification Form #193 must be filled out completely and sent along with the box, or, filled out electronically and sent with the bar code identification.

It is always better to include more information than necessary. At a minimum, include the following:

21

Sample identification written on the box

- Date and time the sample was obtained
- Station and Direction (NB, SB, EB, or WB)
- Tonnage at which the sample was taken (if known)
- Lift (Surface, Intermediate, Base)
- Project Number
- **Mix Design Number**
- Sample ID #

22

Sample identification written on the Form #193

- Mix Type
- Lift (Surface, Intermediate, Base)
- Project Number
- **Mix Design Number**
- Contractor
- The person who took the sample
- Sample ID #
- Who the report is being sent to

23

Explanation of Sample ID

Sender Sample No. IN 10-25A

IN stands for Intermediate lift (BA is base, SU is surface)

10-25 stands for October 25th, the date the sample was taken using a month/day format

A stands for the first box of the day (A, B, C, D, E….first box, second box, etc.)

24

Explanation of Sample ID#

- Other sample identification methods may be used, including bar codes.
- Always check with the District Lab before submitting samples to find out what method of identification is required.

25

IOWADOT
Form 820193
(03-17)

Highway Division
Office of Construction and Materials
Ames, Iowa

Central
Lab No.: _____

IDENTIFICATION OF SAMPLE TEST

Material: HMA VT Surface 1/2" @ 5.2% Asphalt Binder

Barcode Security ID No.: D1-000144

Intended Use: HMA VT Surface

Sender's Sample No.: SU10-25A

County: Polk

Contract ID No.: 77-0355-097

Project: IMX-35-5(97)121--02-77

Mix Design No.: ABD23-1045

Contractor: Quality Asphalt Inc. (Name) _____ (Address)

Supplier: _____ Source: _____

Producer: Quality Asphalt Inc.

Brand: _____

Lot No./Heat No.: _____

Location of Producing Plant: US Highway 6 Altoona

Quantity Represented: 1 40 Lb box from first sublot of Approx. 750 tons

Sample by: John Rayson witnessed by Bob Anderson (Name) _____ (Address)

Date Sampled: 10-25-2023

Date Received: _____

Report to District Materials *[Check appropriate box(es)]* Dist 1 ☒ Dist 2 ☐ Dist 3 ☐ Dist 4 ☐ Dist 5 ☐ Dist 6 ☐

Report to Residency *(Write appropriate residency number)* ☐☐ ☐☐ ☐☐ ☐☐ ☐☐

(Last two digits of Cost Center)

Report to Counties *(Write appropriate county number)* ☐☐ ☐☐ ☐☐ ☐☐ ☐☐

Report to Other: Quality Asphalt Inc.

Report to Other: _____

Report to Other: _____

Results need by: Date: _____

Additional Detailed information:

Check Sample Type	
☒ V	Verification
☐ PN	Project Information
☐ MD	Mix Design
☐ DI	Dept. Information
☐ WH	Warehouse Stock
☐ IA	Independent Assurance

(NOTE: A representative of the Department of Transportation shall select the sample.)

Distribution: One copy - with the sample; One copy - File

SAMPLING UNCOMPACTED ASPHALT

SCOPE

Three methods are used for sampling asphalt mix to be submitted for laboratory tests.

REFERENCED DOCUMENTS

Standard Specification 2303 Flexible Pavement
Standard Specification 2309 Surface Recycling by Heater Scarification
IM 336 Reducing Aggregate Field Samples to Test Samples
IM 357 Preparation of Asphalt Mix Samples for Test Specimens

APPARATUS

- Metal Sampling Template, with a minimum area of 64 $in.^2$ & 4 in. deep.
- Laboratory Sampling Scoop (Square Pointed)
- Putty Knife
- 2-gallon capacity cardboard box, heat resistant buckets or insulated containers
- Sampling Container
- Ruler
- Quartermaster (Optional)
- Square-pointed Shovel or for sampling from the hopper and windrow sampling: A square-pointed shovel of a size easily handled with built-up sides and back (approximately 1 ½" [37.5mm]) to facilitate the retention of material on the shovel when sampling.

Equipment used for sampling purposes must be clean and free of any materials, which may alter the material properties of the mixture. Extra care should be used when using petroleum distillates or other solvents to clean equipment. If petroleum distillates or other solvents are used to clean equipment, the equipment must be dry prior to use.

PROCEDURE

Sample Size

Samples submitted to both laboratories for testing shall be 40 pounds to run each of the required tests ($G_{mm,}$ G_{mb} and extracted gradation). Samples taken from thick layers will be proportionately larger.

Paired Samples

Field sampling (side-by-side sampling) to obtain paired samples as required providing Agency verification samples and Contractor quality control samples. The Contractor shall obtain asphalt samples in accordance with the procedures outlined in the required sampling method that follow and obtain two boxes of at least 40 pounds from each sample site as directed and witnessed by the Engineer.

When paired samples are required, but a template is not used to delineate the sample such as for base widening, thick lifts or heater scarification, the Engineer will provide direction on the sampling procedures to be used. Adjacent locations for paired samples will be used whenever practical.

After obtaining paired samples, Agency personnel will immediately take possession of one of the two boxes, secure it according to IM 205 Appendix A and fill out sample identification (Form #193) before returning the sample to the Contractor for transport to the Agency's testing lab.

Sampling Methods

The District Materials Engineer may approve an alternate sampling method to sampling behind the paver (Section A. Pavement Sampling) when field conditions warrant. Sampling safety and materials aspects of the project should be considered when selecting the sampling method.

NOTE: Extreme care shall be taken to minimize segregation of coarse and fine particles while the sample is being taken. **NOTE:** Extreme care shall be taken so as not to contaminate the sample with any foreign matter (Fuel oil, dust, etc.).

A. Pavement Sampling

This method of sampling asphalt mixture is not to be used in situations involving Heater Scarification Work as stated in Standard Specification 2309.

1. Samples shall always be taken behind the laydown machine before the material receives any compaction. Sampling shall be distributed over at least 30 tons of mix placed (approximately two different truckloads).

2. The template shall be placed on the mat and forced straight down through the entire depth of the mat being laid. All material inside the template shall be scooped out and placed uniformly in the sample container(s). The scoop is used to remove the material from the inside of the template. All the material, which has stuck to both the inside and outside of the scoop, shall be scraped off and added to the sample. The engineer may adjust the details of this procedure when samples are obtained from courses placed on earth subgrades, untreated subbases, and bases to prevent contamination. **NOTE:** Any material adhering to the inside of the template shall be scraped off and added to each template sample.

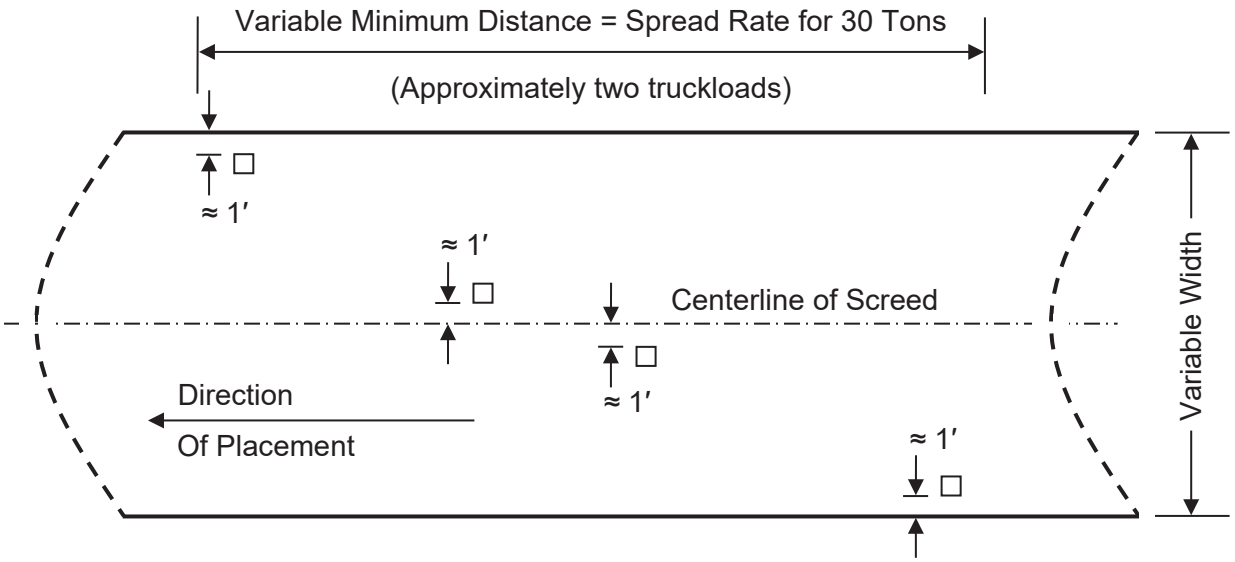
3. For paired samples, after obtaining each template sample for the first box, the template shall be moved longitudinally so that the second template sample site shares a common edge (not more than 4 inches apart) with the first. A double template with a divider in the middle may be used to expedite the paired sampling. When using a double template, scraping the material from the inside of the template needs to be done only once at the completion of sampling.

   Perform the same procedures as stated in step 2 to remove all materials from the adjacent location and place this material in the second box.

4. Samples shall be taken to represent a cross-section of the mat as follows:

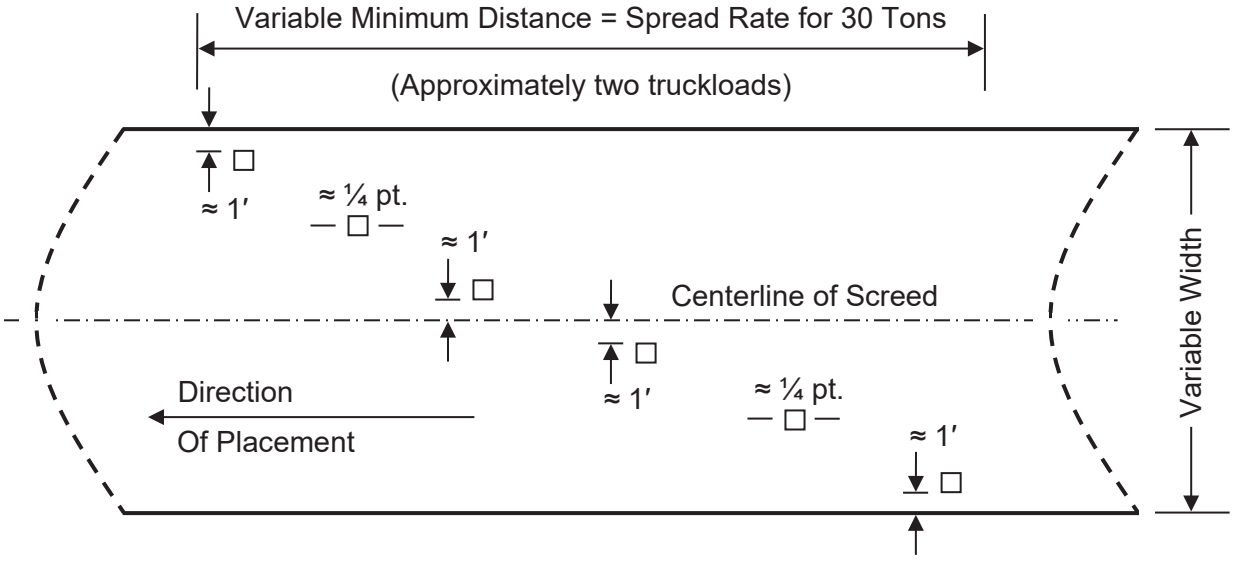
   a. A minimum of four template samples shall be taken. One approximately 1 foot in from the left edge of the mat, one approximately 1 foot left of the center of the screed, one approximately 1 foot right of the center of the screed, and one approximately 1 foot in from the right edge of the mat. (See Diagram 1.)

DIAGRAM 1



b. If six template samples are needed to yield a sample of sufficient size, an additional template sample shall be taken approximately on each quarter point. (See Diagram 2.) If eight or more template samples are needed to yield a sample of sufficient size, two or more repetitions of four or six template samples may be required.

DIAGRAM 2



5. When sampling from thick lifts (generally greater than 3 inches in thickness), obtain the sample in increments as outlined above except a metal straight edge or a square point shovel may be used to delineate the sample sites in lieu of the template. When using the shovel to sample thick lifts, the shovel is first used to delineate the sample area and remove the material that is not part of the sample by creating a vertical face and pulling

the shovel and excess material away from the sample area. Then the shovel can be used to remove the sample. The scoop can be used to finish the sampling to be sure that all mix within the delineated area is included in the sample increment. If the four segments required in section 3a result in excess mixture, the additional mixture shall be forwarded to the appropriate laboratory. Large samples shall be carefully combined and reduced at the laboratory prior to testing.

6. When mix is placed in narrow widths such as base widening where the above sampling pattern will not work, a sample shall be obtained in a minimum of two increments from near the center of the placement and spread out over at least 30 tons or approximately two truckloads.

B. Hopper Sampling

This method of sampling asphalt mixture shall be limited to projects using HMA Interlayer and High Performance Thin Lift Overlay mixes, as well as the Heater Scarification Process as stated in Standard Specification 2309.

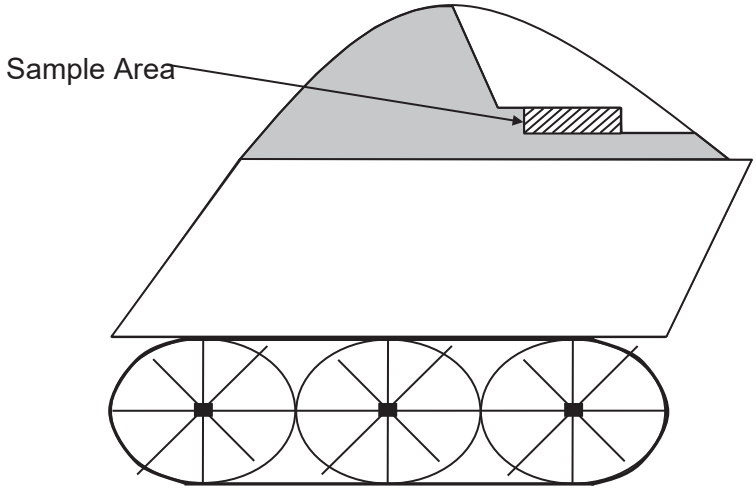
1. The sample shall always be taken from the paver hopper for the Heater Scarification Process.

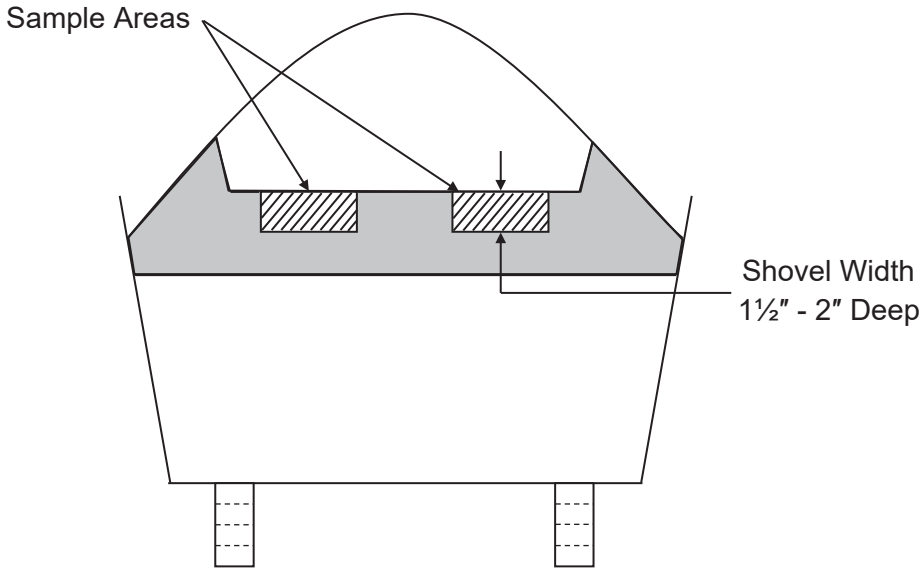
2. A square pointed shovel shall be used to prepare the sampling area and to take the sample.

3. The sample shall be built up from a minimum of 30 tons of mixture placed (approximately two different truckloads).

4. The sample shall be taken from a location, which is as near the center of the mass of a nearly full hopper as practically possible. A flat surface shall be prepared by removing mix downward from the peak until the desired benched area is reached. Just prior to taking the sample, all foreign material shall be scraped from the shovel. The sample shall be removed from the benched area in a manner that will assure collection of sample material over an area, which is of uniform dimension. Paired sampling requires two samples be taken from the same benched area in the hopper. Space the sampling pairs so each sample is obtained from a uniform, undisturbed portion of the benched material. Do not locate a paired sample in material disturbed from taking the first sample.

5. Any material adhering to the inside of the shovel shall be scraped off and added to each sample. Scrape the leftover HMA material on the inside of the shovel only. If taking paired sample, equally distribute scrapped material into both sample containers.





C. Windrow Sampling

This method covers sampling asphalt material from the windrow at the jobsite. These samples may be utilized when sampling behind the paver is not practical, and the hopper is not accessible.

When sampling from the windrow, use a square-pointed shovel with built-up sides and back (approximately 1 ½") to facilitate the retention of material, especially coarse aggregates, during the sampling process.

1. Obtain sample at a minimum of three locations along the windrow. Choose locations along the windrow that appears uniform; avoid the beginning or the end of the

windrow section. Each sample is obtained in at least three increments at a minimum of three locations along the windrow. Sample increments must be located a minimum of 6 feet apart as shown in diagram below. Illustration shows paired samples “A” and “B”.

2. Remove approximately 1 foot from the top of the windrow. See windrow cross section diagram below.

3. Bench out a section at intermediate height on one side of the windrow, as shown in cross section diagram below. For paired samples, bench out a section that is large enough for sampling side-by-side paired samples, as shown in the illustration.

4. Just prior to taking the sample, all foreign material shall be scraped from the shovel. Use the square-pointed shovel with built up sides to obtain one increment of the sample from the benched section. The sample shall be removed from the benched area in a manner that will assure collection of sample material over an area, which is of uniform dimension. Insert the shovel horizontally into the benched section of the windrow (labeled “sample” in the diagram below). The illustration’s “sample” dimensions are a shovel width wide and approximately 1.5”-2” deep. Paired sampling requires two samples be taken from the same benched area of the windrow. Space the sampling pairs so each sample is obtained from a uniform, undisturbed portion of the benched material. Do not locate the paired sample in material disturbed from taking the first sample.

5. Obtain a minimum of two additional sample increments per sample at additional locations (minimum of three) along the windrow.

6. Any material adhering to the inside of the shovel shall be scraped off and added to each sample. Scrape the leftover HMA material on the inside of the shovel only. If taking paired sample, equally distribute scrapped material into both sample containers.

7. Deposit bituminous material in suitable container; prevent contamination and segregation of material.

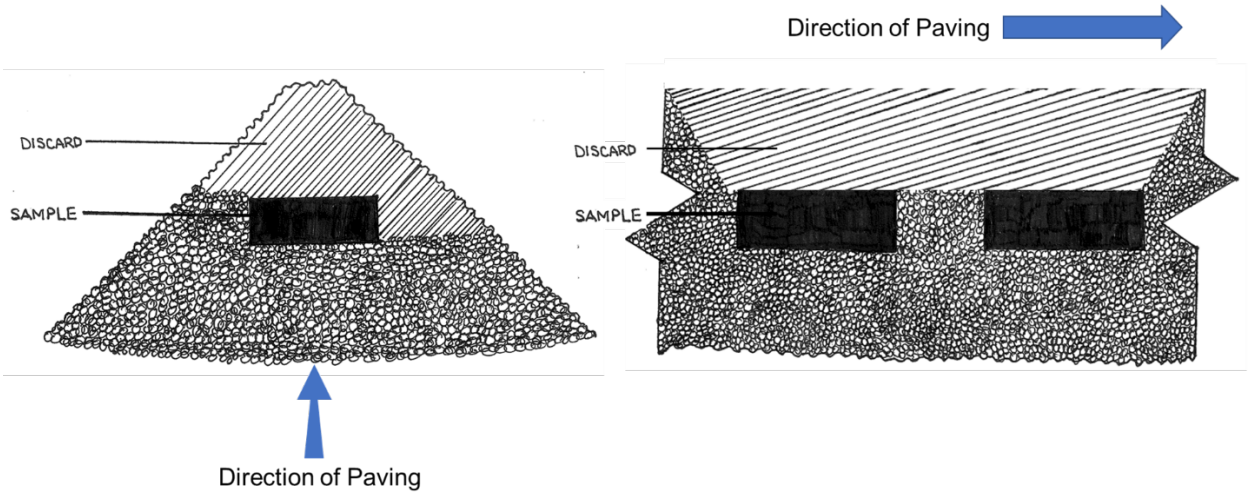


Illustration of windrow cross section and one paired-sample increment.

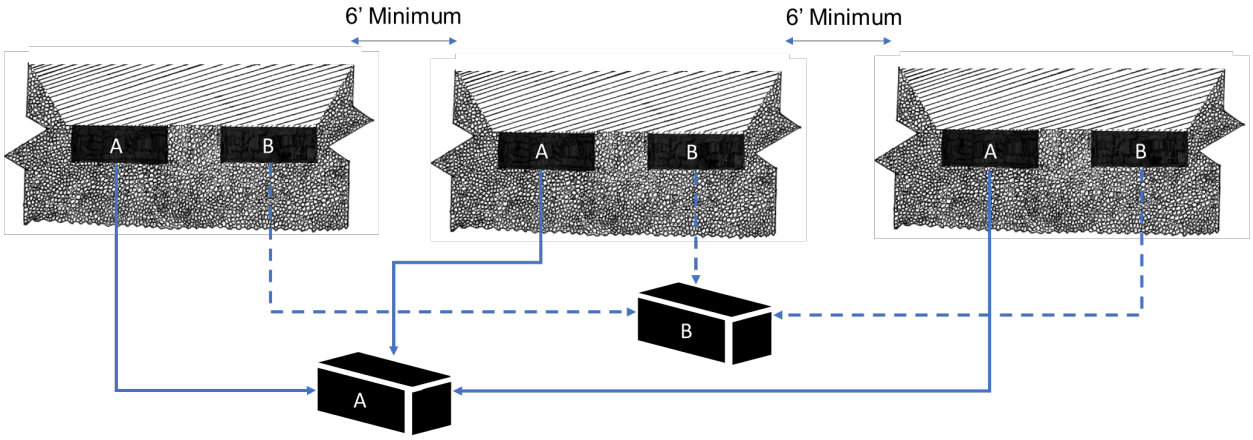


Illustration of paired sampling along the windrow. Repeat sampling increments as needed.

Sample Splitting

These splitting methods are to be used for reducing large field samples to lab sample size and to provide split samples for testing in multiple labs. To reduce samples to test sample size see IM 357.

The order of preference of sample splitting is as follows:

A. Quartermaster (Or Similar Quartering Device)

1. Place the entire sample in the Quartermaster. **NOTE:** Take care to avoid segregation when placing material in the Quartermaster.

2. Release the gate to split the sample into four smaller samples.

3. Take the split material from opposite corners and recombine to obtain two boxes of material.

B. Riffle Splitter

Follow procedure I, Splitting Method, in IM 336 with the following exceptions:

1. Only one cycle of this process is performed to obtain the desired sample size for both labs.

C. Manual Splitting

Follow procedure IV, Quartering Method, in IM 336 with the following exceptions:

1. Only one cycle of this process is performed to obtain the desired sample size for both labs.

Sample Delivery & Retention

1. Each sample shall be carefully labeled by the Agency Inspector.

2. The Contractor will transport the boxes to the Contractor's QMA laboratory.

3. The Contractor's certified technician will test the unsecured box of the paired sample at the Contractor's QMA laboratory for testing.

4. The secured box of each paired sample will be retained at the Contractor's QMA laboratory until delivered by the Contractor to the testing lab designated by the Engineer.

5. The Contractor shall retain all samples and test specimens for a lot until the Contracting Authority accepts the lot. **NOTE:** The Contractor should retain all samples until notified by the Contracting Authority that the material is no longer required.

CORES

COMPACTED FLEXIBLE PAVEMENT SAMPLING

(CORES)

Cores are required to be sampled from the completed pavement for testing to determine thickness, density, and air voids. The core being sampled must represent the pavement layer as placed. (Base, Intermediate, Surface).

The proper procedure involves cutting samples from the completed pavement. Specifications require the cores to be cut as promptly as practical. Cores should be sampled no later than the following workday. Proper safety precautions must be taken.

The number of core samples needed each LOT is determined by specification. For a PWL project there will always be 8 cores/lot cut from the travelling portion of the road, and 3 cores/lot cut from the joint (if it's a surface course and a qualifying joint is built).

A LOT is one layer of one mixture bid item placed during one day's operation

The Agency's inspector will determine the location within each lot by using the random number generator spreadsheet provided by the Iowa DOT. This can be found at: http://www.iowadot.gov/Construction_Materials/hma.html

Once the locations are determined, the Agency's inspector will mark out the location on the pavement, and the contractor will cut the core from that location. The contractor must take care when cutting the cores to avoid damaging them. Cores will then be safety transported to the Contractors lab for testing.

Spec 2303 explains the thickness requirement for cores.

IM 320 explains the proper sampling procedure for sampling compacted asphalt mixtures.

*This sample must be directed and witnessed by the Agency's Inspector. The contractor can take as many samples as they'd like for their own Quality Control, but only the directed and witnessed samples are used for Acceptance. The Agency's Inspector will supply the security items and complete the Form 193 if necessary.

Station Select

RANDOM CORE SAMPLES version 2.00

*Use for PWL lots and test strips under PWL

For Class I Compaction, only the quantity within the 12.0 ft area is included for a PWL field voids lot

PROJECT 123

COURSE LAID Surface

DATE LAID

MAT THICKNESS 2.00 IN.

TRAVEL LANE(S) WIDTH 12.0 FT. <REQUIRED

WIDTH OF PAVER UNIT 14.0 FT. <REQUIRED

DATE CUT

MAT

From STATION	To STATION	Length (L.F.)	Direction/ Lane	# MAT Cores
1.00	5.00	400.00	NB	2
400.00	410.00	1,000.00	SB	6
		0.00		
		0.00		

Total Mat Cores = 8
Total Length = 1,400.00
Avg Sublot Size = 175.000

JOINT

Longitudinal Joint Created? (None/Full/Partial)	From STATION	To STATION	Length (L.F.)	# JOINT Cores
No Joint Created				0
Partial (<1,000 ft) Joint Created	402.00	410.00	800.00	3
No Joint Created				0
No Joint Created				0

Total Joint Cores = 3
Total Length = 800.00
Avg Sublot Size = 266.667 <Enter this value in the coreworksheet_201

***If a joint is created today, the random locations will be marked for coring below.**

CORE # 1: 200.000 X 0.917 = 183.355 + STA. 1.00 = **STATION** **2.83** NB
12.0 X 0.712 = **8.5** **FT.** (Offset)

CORE # 2: 200.000 X 0.208 = 41.681 + STA. 3.00 = **STATION** **3.42** NB
12.0 X 0.494 = **5.9** **FT.** (Offset)

CORE # 3: 166.667 X 0.531 = 88.464 + STA. 400.00 = **STATION** **400.88** SB
12.0 X 0.488 = **5.9** **FT.** (Offset)

CORE # 4: 166.667 X 0.148 = 24.637 + STA. 401.67 = **STATION** **401.91** SB
12.0 X 0.970 = **11.0** **FT.** (Offset) 11.0 FT. max

CORE # 5: 166.667 X 0.424 = 70.699 + STA. 403.33 = **STATION** **404.04** SB Joint Core # 1
12.0 X 0.049 = **1.0** **FT.** (Offset) 1 FT. min

CORE # 6: 166.667 X 0.805 = 134.207 + STA. 405.00 = **STATION** **406.34** SB Joint Core # 2
12.0 X 0.474 = **5.7** **FT.** (Offset)

CORE # 7: 166.667 X 0.514 = 85.637 + STA. 406.67 = **STATION** **407.52** SB
12.0 X 0.359 = **4.3** **FT.** (Offset)

CORE # 8: 166.667 X 0.095 = 15.778 + STA. 408.33 = **STATION** **408.49** SB Joint Core # 3
12.0 X 0.532 = **6.4** **FT.** (Offset)

Sampling Compacted Pavement

Cutting cores

Agency's Inspector will use a template and mark out a 16" circle on the finished pavement.

A Density Gauge is not to be used to find the best place to cut a core! The core locations must be random.

Core Diameter

Specifications require the cores to have a 4” minimum diameter for cores taken from the travelling portion of the pavement, and a 6” minimum diameter for joint cores.

CUTTING AND CARE

- Core bits should be kept sharp
- Truck Mounted Core Drill typically used
- Water injection
- Take care not to damage when removing
- Drill will drill down to the tack coat, and then the core can generally be removed with a hard knock.

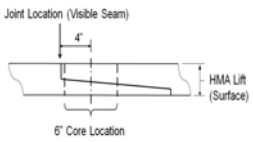
Cutting Joint Cores

- Place the drill in the proper location over the joint
- Location depends on the type of joint created
  - Notched Wedge Joint
  - Vertical (BUTT) Joint

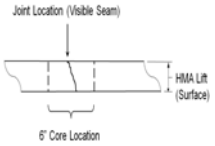
Proper placement ensures core contains approximately 50% of each side

Joint Core: Notched Wedge or Butt Joint?

NOTCHED WEDGE



BUTT JOINT



Cutting and Care

- If core cannot be removed with a hard knock, drill full-depth and the underlying layers will be removed in the lab
- Measure cores before trimming, to determine the thickness of the representative layer

Core Thickness Requirements

- Specifications Requires the cores cut from the travelling lane to be between 70% and 150% of the intended mat thickness in order to be valid samples.
  - Example: The plans call for a 2" lift
    Cores cut for that lift must be between 1.4" and 3"

Core Thickness Requirements

If core is too thick or too thin a replacement core must be cut. In this case do not cut from within the circle template, move away to an alternate location determined by the engineer (agency inspector).

Core Thickness Requirements for Joint Cores

- The thickness spec does not apply to joint cores.
- Joint cores are measured and tested regardless of their thickness.

Check the core for damage

- Damaged cores cannot be tested
- Typical damage
  - Cracks
  - A piece that has broken or fallen off
  - Denting or distortion caused by prying out of the hole

Damaged Cores

- If a core is damaged, a replacement core must be cut. If the thickness is okay, cut the replacement core from an alternate location (within the 16" circle if possible)
- Both the Contractor and Agency's inspector must agree that a core is a "good" core

Core Transportation

- Monitor will transport the cores to the contractor's lab
- Or, the monitor will secure the cores in a core box for the contractor to take to the lab
  - Transport on a hard, flat surface
  - If possible, use a core box obtained from the Central DOT offices
  - Cores should not be placed in a pail of water
  - Cores should not be placed in a cardboard box
  - Cores should NEVER be kept in a freezer
  - If it's a long trip, cores can be put in plastic bags and placed in a cooler with some ice to prevent them from getting too hot and falling apart

Back at the Lab

- Cores should be placed in front of fans and allowed to “air dry” before testing
- If the core has part of the old road or the lower lift still attached, the contractor will saw off the underlying layers (remember to measure thickness before doing that)
- Remove the tack coat. Only saw the tack coat off if necessary (sawing seals the surface of the core approximately 60%)
- Once dry and prepped, cores can be tested.

In Summary

- Must have “test-able” cores
  - Proper diameter
  - Proper thickness
  - No damage present
- Once cores are tested, the results stand. A core cannot be determined “damaged” after the fact just because the answer is off.
- Incentive / Disincentive payment is attached to the results of core testing. VERY important to ensure cores are treated VERY carefully.

METHOD OF SAMPLING COMPACTED ASPHALT MIXTURES

SCOPE

This IM provides the procedures used for sampling compacted asphalt mixtures.

REFERENCED DOCUMENTS

IM 204, Inspection of Construction Project Sampling & Testing

APPARATUS

- Core drill suitable for cutting a sample from the mat with a minimum 4” nominal diameter bit. Note: 6” nominal diameter is needed for joint coring.
- Core tongs if a core drill is used to cut the sample
- Hammer
- Steel plate 4 in. wide, 4 in. long, 1/8 in. thick and curved to fit firmly around the core being taken. A piece of core bit will serve this purpose.
- Wedge – A small cold chisel makes a suitable wedge.

PROCEDURE

1. Unless otherwise specified, sampling frequency shall comply with IM 204 and applicable IM 204 appendixes. Sample sites shall be randomly located by the Engineer.

> **NOTE:** Exercise care during sampling, handling, transporting and testing to minimize possibility of damaging the specimens.

2. Drill completely through the layer being sampled.

> **NOTE:** If samples are to be cut from compacted mixtures that are still warm, it may be necessary to subject the sample site to artificial cooling equivalent to surface contact with ice for approximately 20 minutes.

3. Use the curved steel plate for protection of sample. Then place the wedge behind the plate and strike it with a sharp blow from the hammer. This will snap the sample loose.

4. If a layer being sampled adheres to a lower layer such that it is necessary to remove two or more layers during the sampling process, cool the composite sample and remove the extraneous material before testing by sawing or other suitable methods.

> **NOTE:** Under no circumstances shall the cores be submerged in water before testing.

5. All samples shall be carefully inspected for damage before testing. Samples that are damaged shall be replaced by additional samples obtained as outlined above.

6. Mark the core for later identification.

DOCUMENTATION

Assign a number to each core and record the core number, date sampled, station, and transverse position on the appropriate form.

METHOD TO DETERMINE THE THICKNESS OF COMPLETED COURSES OF BASE, SUBBASE & HOT MIX ASPHALT

SCOPE

This method covers the sampling and measurement procedures for determining the thickness of completed courses of pavement.

REFERENCED DOCUMENTS:

IM 320, Method of Sampling Compacted Asphalt Mixtures

APPARATUS

1. Complete core drilling apparatus as required in IM 320 or as furnished by the contractor.
2. Straightedge at least 18 in. long
3. Ruler with graduations of 1/16 in.
4. Tape measure

PROCEDURES

Specifications and instructions require that the thickness of the completed pavement courses be measured to the nearest 1/8 in. by means of cores, measurement of hole depth or measurement of the side of the trench, as directed by the engineer. Sample sites shall be randomly located.

A – THICKNESS DETERMINATION BY CORE MEASUREMENT

A-1 If the compacted material has sufficient cohesion and strength to permit the drilling and handling required to obtain an undisturbed core, this method should be used.

A-2 Drill through the course and remove the core. Perform thickness measurements before trimming core. Refer to IM 320 for drilling and removal procedures.

A-3 Measure with a ruler, to the nearest 1/8 in., the thickness of the pavement course. Make four measurements, along the edge of the core at 90° intervals.

A-4 Assign a number to the core and record the core number, date drilled, station, transverse position (distance from centerline) and core measurements.

A-5 Retain all samples obtained from lots of construction that are determined to be deficient until final disposition of the lot is made as provided for by the specifications.

B – THICKNESS MEASUREMENTS BY HOLE MEASUREMENT

B-1 If the core breaks, while drilling or handling, or if it crumbles or disintegrates in the hole while drilling, the hole may be measured.

B-2 Place a straightedge at least 18 in. long, flat on the surface so as to establish the plane of the surface surrounding the hole.

B-3 Measure with a ruler, to the nearest 1/8 in., the distance perpendicular from the straightedge, laid across the center of the hole, to the bottom of the hole.

B-4 Take two measurements along the edges on opposite sides of the hole with the straightedge parallel to the centerline of the road, and two with it perpendicular to the centerline.

B-5 If the core breaks, but the portion in contact with the subgrade remains intact, remove it and measure to the nearest 1/8 in. the amount of the subgrade material adhering to it at four points on the edge of the core at 90° intervals. Subtract the average depth of subgrade material for the average depth measurement of the entire depth of the hole as made in B-1 to arrive at the average thickness.

B-6 Record the station, lateral position, date measured, and the depth of hole measurements.

C – THICKNESS DETERMINATION BY SIDE OF TRENCH MEASUREMENT

C-1 If accurate measurements cannot be obtained as outlined in Section A or B, the engineer, at his/her discretion may require the course to be dug open with any hand or mechanical means which will produce an opening large enough, and of sufficient depth, to permit viewing of the pavement course profile and the subgrade immediately under it. Obtain at least four measurements from the surface to the bottom of the course as viewed in the trench as described in Section B.

CALCULATIONS

Average the individual measurements for each core or hole to the nearest 1/8 in., and record in the appropriate field book and report form.

EXAMPLE DETERMINATION OF QUALITY INDEX (QI)

Design thickness 4 in.

Individual core averages as determined and recorded per this IM.

4.50 in.
3.75 in.
4.00 in.
4.12 in.
3.50 in.
3.88 in.
4.12 in.

Average = 3.982 in.

Range = (high value - low value) = 1 in.

$$QI = \frac{\text{Average - (Design - 0.5)}}{\text{Range}}$$

$$QI = \frac{3.982 - (4.00 - 0.5)}{1.00}$$

$$QI = 0.48$$

Report QI upon completion of each lot. Refer to applicable specifications for specific details and disposition for each type of construction.

CONTROL OF ASPHALT MIXTURES

SCOPE

This IM describes the Quality Control/Quality Assurance (QC/QA) procedures for monitoring and controlling plant-produced asphalt concrete mixtures on Quality Management of Asphalt (QMA) projects.

REFERENCE DOCUMENTS

Standard Specification 2303 Flexible Pavement
IM 204 Inspection of Construction Project Sampling & Testing
IM 205A Securing Samples
IM 208 Materials Laboratory Qualification Program
IM 213 Technical Training and Certification Program
IM 216 Guidelines for Validating Test Results
IM 301 Aggregate Sampling & Minimum Size of Samples for Sieve Analysis
IM 302 Sieve Analysis of Aggregates
IM 319 Moisture Sensitivity Testing of Asphalt Mixtures
IM 320 Method of Sampling Compacted Asphalt Mixtures
IM 321 Method of Test for Compacted Density of Hot Mix Asphalt (HMA)(Displacement)
IM 322 Sampling Uncompacted Hot Mix Asphalt
IM 323 Method of Sampling Asphaltic Materials
IM 325 Compacting Asphalt Concrete by the Marshall Method
IM 325G Method of Test for Determining the Density of Hot Mix Asphalt (HMA) Using the Superpave Gyratory Compactor (SGC)
IM 336 Reducing Aggregate Field Samples to Test Samples
IM 337 Method to Determine Thickness of Completed Courses of Base, Subbase & Hot Mix Asphalt
IM 338 Method of Test to Determine Asphalt Binder Content & Gradation of Hot Mix Asphalt (HMA) by the Ignition Method
IM 350 Method of Test for Determining the Maximum Specific Gravity of Hot Mix Asphalt (HMA) Mixtures
IM 357 Hot Mix Asphalt (HMA) Mix Sample for Test Specimens
IM 501 Equations and Example Calculations
IM 510 Method of Design of Hot Mix Asphalt Mixes

RESPONSIBILITIES

Appendix A contains an outline of the responsibilities required for all parties. Refer to IM 213 Appendix C for individual certification requirements.

SAMPLING & TESTING

Sample and test according to Section 2303. Only the information obtained from random samples as directed and witnessed by the Engineer and validated by comparison to one or more of the paired samples tested by the Contracting Authority will be used for specification compliance. Additional samples of aggregate and uncompacted asphalt mixture may be taken by the contractor to provide better quality control. The results of testing done on additional samples will be for informational purposes only and do not need to be reported.

All testing done by the Contractor that is used as part of the acceptance decision shall be performed in qualified labs by certified technicians. Gyratory compactors not utilized in the independent assurance testing (IM 208 Appendix C) will not be allowed on QMA projects without permission from the District Materials Engineer (DME).

Retain samples taken for acceptance purposes until the contractor's results have been validated.

A. UNCOMPACTED ASPHALT MIXTURE

The specific ton or truckload to begin sampling will be determined by the Engineer using the spreadsheet (https://iowadot.gov/Construction_Materials/hma/hmarandomsamples.xlsx). The total estimated daily production is divided into equal sublots based on the number of samples determined from Table 2303.03-5.

EXAMPLE
Estimated production = 4,501 tons
Number of Samples = 5
Approximate sublot size = 4501/5 = 900 tons

When production of a bid item is expected to exceed three production days (small quantities excluded) and conditions/resources reasonably allow, test samples immediately "hot-to-hot" (without allowing the sample to cool) for at least one day at the beginning of production to aid in any future investigation of non-correlation that may arise throughout production.

Calibrate the Rice pycnometer at the beginning of a project and anytime that a correlation problem occurs.

B. COMPACTED ASPHALT MIXTURE

1. For class I compaction, the width subjected to the random sampling shall coincide with the width eligible for PWL incentive/disincentive. This width shall be the nominal width of the travelled lane unless otherwise determined by the Engineer. Take samples from no less than 1 foot from the unconfined edge of a given pass of the placing equipment, except when the width of a single pass of the paver exceeds the width eligible for random sampling by more than 1 foot (i.e. For a 14-foot paving width on a 12-foot wide lane, a core location could randomly fall exactly 12 feet from centerline, assuming a two lane roadway. The outside 2 feet would then be deducted from the field voids lot quantity).

2. The Engineer will provide inspection staff to direct and witness the sampling and perform G_{mb} measurement during a time agreed between the Engineer and the Contractor. The Engineer should make every effort to meet the Contractor's schedule.

3. The Engineer will transport the cores in accordance with IM 320, or secure the cores for transport by the contractor. The Engineer and Contractor will determine that cores are not damaged. The Engineer will decide if a core is damaged prior to testing.

C. ASPHALT BINDER

Sample and test according to IM 204. For DSR verification tests performed at the District laboratory, if the G*/sinδ falls below 1.0, obtain a quart sample for full analysis and test all remaining 4 oz. samples until the area of noncompliance is isolated.

The Engineer may price adjust the asphalt binder for the following quality characteristics

- G*/sinδ (un-aged)
- Percent Recovery
- M-value

VALIDATION

A. Defined

Validation is defined as the ability of two labs to achieve similar (statistically equivalent) test values on split or paired samples.

B. Aggregate Gradation Correction Factor

When comparing the cold-feed gradation to the ignition oven extracted gradation, a correction factor to adjust the extracted gradation must be determined in accordance with IM 501. Validation of the cold-feed gradation will be determined by comparing the cold-feed gradation and the corrected extracted gradation as shown on the comparison report for Cold-Feed & Ignition Oven in IM 216 Appendix A. The correction factors will be established by comparing an Agency cold-feed sample to an Agency ignition oven extracted sample. The Engineer may witness and secure a split cold-feed sample according to IM 205 Appendix A for validation in lieu of an ignition oven sample, in which case a correction factor is not needed.

C. Validation Requirements

1. When any of the following events occur, validation has not been achieved or maintained:
   a. The difference between test results on each of two consecutive split/paired samples exceeds the IM 216 tolerance.
   b. The difference between test results on any two of three consecutive split/paired samples exceeds the IM 216 tolerance.
2. Consecutive samples may be either validation samples tested sequentially with another lab or mix specific samples when other mixes are being tested for validation between the two labs. It may be necessary to examine validation of test results on consecutive samples **of the same mix** if more than one mix is being tested between the two labs. Validation problems sometimes only occur during testing of specific mix samples.
3. When validation for a particular test has not been achieved, all results for that day are considered invalid for that test.
4. To achieve or reestablish validation, a minimum of two consecutive test results must meet IM 216 tolerances.
5. When noncomplying material has been removed, the test results corresponding with the material will remain in the validation decision.

DISPUTE RESOLUTION

A. Investigation

When validation is not achieved or maintained, the DME will act as appropriate to

resolve split/paired test result differences by choosing among the strategies below. The DME shall report the results of the investigation to the Contractor upon its conclusion. The DME may consider results from the Independent Assurance Program in the investigation. When non-validation of test results cannot be explained by an assignable cause as determined by the DME, the Engineer's results will be used for acceptance.

1. Retest the same sample
2. The District labs will test additional verification samples.
3. The DME will review the sampling and testing procedures of both labs
4. The DME will immediately test samples sent in by the Contractor without allowing cool down and reheating (hot-to-hot testing).
5. Both labs will test samples using comparable reheat periods.
6. The DME will establish a correction factor based on the reheat evaluation outlined in Appendix B.
7. Both labs will test a sample that was taken and split by the Engineer.
8. Both labs and a third laboratory designated by the Contracting Authority will test a sample split three ways. The 3rd lab for state projects will normally be the Central Materials Lab.
9. The DME will establish a correction factor for the Contractor's gyratory compactor based on the procedure described in Appendix C. The correction factor for G_{mb} should not exceed 0.030.
10. Verify both labs are compacting to the number of gyrations specified in the contract documents.

B. Quality Assurance Protocol
   1. Resolution decisions by the Iowa DOT Central Materials Laboratory will be final.
   2. During the period of production when validation cannot be achieved, the Engineer's test results will be used for acceptance of the lot. The use of the Engineer's test values for acceptance will be retroactive to the time when the first sample exceeded the validation tolerance. Similarly, when validation is regained, the use of the Contractor's test results for acceptance is retroactive to the first test used to reestablish validation.
      a. Over the period which validation cannot be achieved for aggregate gradation, the Engineer's test results will be used for the entire gradation and applied to any calculations involving the gradation for the entire lot.
      b. If validation cannot be achieved between the ignition oven extracted gradation and the Contractor's cold-feed gradation, the Agency will run cold-feed gradations for validation in place of the ignition oven.
      c. Over the period which validation cannot be achieved on uncompacted asphalt mixture tests for G_{mm} or G_{mb}, the Engineer's test results will be used as follows:
         i. For lots under the PWL acceptance plan,
            The Engineer's results and any other valid contractor's results for the lot will be used in the calculations for field voids and lab voids.
         ii. For all other lots, the Engineer's results will be used for any calculations involving that particular test value.
         iii. Use a maximum lot pay factor of 1.000 for lab voids and field voids when the Engineer's results are used for any portion of the lot.

PRODUCTION TOLERANCES

Production tolerances are listed in the Section 2303.

Investigate variations between two consecutive test results in G_{mb} or G_{mm} of more than 0.030 promptly since these tests reflect significant changes in binder content, aggregate properties and/or gradation. In some cases variations may be attributed to segregation, thoroughness of mixing, sampling procedure, and changes in aggregate production.

If the test results in a series of split/paired samples (minimum of 3 samples) are not variable and random (results are consistently higher or results are consistently lower) and the difference between each split/paired test result is greater than half of the IM 216 tolerance, the DME may establish a correction factor for the Contractor's gyratory compactor based on the procedure described in Appendix C. The correction factor for G_{mb} should not exceed 0.030.

REPORTING

For each production sample of loose asphalt mixture the Contractor will determine, report, and plot G_{mb}, G_{mm} and P_a. Binder content measurement by an approved method will be determined, reported, and plotted daily. Gradation will be determined, reported and plotted daily. Make the inter lab correlation reports available.

Test results are to be recorded and plotted in the computer programs provided by the Iowa DOT (https://iowadot.gov/construction_materials/Hot-mix-asphalt-HMA). The computer programs act as a tool for documenting project data and applying the specification. The specification and IMs will always govern when errors are encountered in the software. Microsoft Excel 2007 (or newer) is required (or equivalent spreadsheet software capable of reading and writing *.xlsm and *.xlsx file types). The recommended minimum system requirements include a 2.3 Ghz processor or higher with at least 2 GB of physical memory and a wireless network adapter with internet access. Copies of the electronic spreadsheet file containing the completed Daily HMA Plant Report shall be provided to the DME and the Engineer within 4 hours of beginning operations on the next working day. The Engineer may extend this time on days when longitudinal joint cores are sampled and tested. Alternatively in these cases, the Engineer may accept partially completed reports until results are available. Use electronic mail (or DocExpress®) as the method of delivery unless otherwise approved by the Engineer. Copies of computer files containing the project information shall be furnished to the Engineer on a CD or portable memory device upon project completion. An additional copy of the files shall be furnished to the DME on a CD or portable memory device.

Keep the charts current and available showing both individual sample results and moving average values for both lab voids and absolute deviation from target. Base moving average values on four consecutive sample results.

MIXTURE AND BINDER SUBSTITUTIONS

At no additional cost to the Contracting Authority, the Engineer may approve the substitution of any mix design which meets or exceeds the requirements of the original mix. Mixture substitutions shall be gyrated to the same level as the original mix requirements. Binder substitutions have an equal or better low temperature PG grade and MSCR designation.

EXAMPLE

Original Mix

ST Intermediate with a PG 58-28S

Requested Substitution

HT L-2 Surface with a PG 58-28H

The request would be approved provided the HT Surface mix is gyrated to the same level as a ST Intermediate with lab voids within the target range. The binder substitution would be approved since it meets or exceeds the low and high temperature grade and has an equal or better letter designation. The aggregate quality of a HT Surface also meets or exceeds that of a ST Intermediate. The Engineer may approve an alternate maximum aggregate size.

A polymer modified binder may be substituted into the JMF provided the original PG grade and temperature spread is met or exceeded. In this case, verify the JMF target air voids are met at the design binder content. If the original JMF required moisture susceptibility testing and has consistently demonstrated acceptable SIP values in the field, the original anti-strip agent (if needed) and dosage rate may be used in lieu of IM 319 re-evaluation. Plant produced mix will still be tested for moisture susceptibility.

ADJUSTING (TROUBLESHOOTING)

The Contractor is responsible for making changes, as necessary, to achieve target values specified on the JMF. These changes can include adjusting the proportions of aggregate and asphalt binder necessary to meet the JMF. If a change in the target gradation is desired, obtain approval of a new JMF from the DME. Changes in the target gradation cannot be set outside of the control points. The Contractor may change the target binder content to maintain the required mixture characteristics, provided the appropriate documentation and reporting is performed. The Contractor may change binder sources provided the Engineer receives written notification (or e-mail) prior to the substitution. Report all changes in proportions on the Daily HMA Plant Report.

The addition of new materials to the JMF may be approved by the Engineer without evaluating mix volumetrics in the laboratory if the materials are produced from geologically comparable sources, do not constitute more than 15 % of the total aggregate, meet quality requirements, and produce mixes that meet design criteria. When aggregates are introduced from sources that are not geologically comparable or otherwise differ significantly, complete laboratory mix design testing and approval is required.

When a stockpile of recycled asphalt materials (RAM) constitutes less than 15% of the JMF, it may be substituted by another source of equivalent classification and quality (Classified or Unclassified) to finish the project. In this case, update the JMF by entering the new RAM binder content, specific gravity, gradation, and absorption into SHADES. Verify the volumetrics remain compliant with the specifications by testing a lab compacted sample.

Moving averages and the gyratory compaction slope assist in identifying potential problems before they arise. Watch the trends in the moving averages (approaching a specification limit) and the slope of the compaction curve. The slope of the compaction curve of plant-produced material shall be monitored and variations in excess of ± 0.40 of the mixture design gyratory compaction curve slope may indicate potential problems with uniformity of the mixture.

TABLE OF RESPONSIBILITY

QUALITY ACTION	CPI & QMA	SMALL QTY.
General		
Use of Qualified Labs & Certified Technicians	CONTR/RCE	CONTR
Use of Certified Labs & Qualified Technicians	DME/CTRL	DME/CTRL
Preparation of the Job Mix Formula (JMF)	CONTR(2)	CONTR(2)
Approval of the JMF	DME	DME
Calibration of the Plant	CONTR	CONTR
Monitoring of Plant Operations	DME/RCE(1)	DME/RCE(1)
Inspection of Plant Operations	CONTR(1)	CONTR(1)
Asphalt Binder		
Direct & Witness Verification Sample of Asphalt Binder	RCE/DME(3)	NA
Sample Asphalt Binder	CONTR(3)	NA
Secure Verification Sample of Asphalt Binder	RCE/DME	NA
Transport Verification Sample of Asphalt Binder	CONTR/RCE	NA
Run & Report Verification Sample of Asphalt Binder	DME/CTRL	NA
Aggregate		
Direct & Witness Verification Sample of Combined Aggregate	RCE(4)	NA
Sample Combined Aggregate	CONTR(4)	CONTR(4)
Direct & Witness Splitting of Combined Aggregate Sample	RCE(5)	NA
Secure Verification Sample of Combined Aggregate	RCE	NA
Transport Verification Sample of Combined Aggregate	CONTR/RCE	NA
Run & Report QC Tests on Combined Aggregate Gradation	CONTR(5)	CONTR(5)
Run & Report Verification Tests on Combined Aggregate Gradation	DME/RCE(5)	NA
Report Validation per IM 216 on Combined Aggregate Gradation	DME/RCE	NA
Obtain & Transport Verification Samples of Coarse Aggregate Quality	DME(4)	NA
Run & Report Verification Tests on Coarse Aggregate Quality	CTRL	NA
Loose Hot Mix		
Determine Loose Hot Mix Paired Sample Frequency/Location	RCE(3)	CONTR
Direct & Witness Verification Sample of Loose Hot Mix	RCE(3)	NA
Sample Loose Hot Mix Paired Samples	CONTR(3)	CONTR(3)
Secure Verification Sample of Loose Hot Mix	RCE	NA
Transport Verification Sample of Loose Hot Mix	CONTR/RCE	NA
Run & Report QC Tests on Loose Hot Mix Samples	CONTR(1)	CONTR(1)
Run & Report Verification Tests on Loose Hot Mix Samples	DME(1)	NA
Report Validation of Hot Mix Tests	CONTR(1)	NA
Evaluate Test Results/Take Action when Validation Fails	DME	NA
Compacted Hot Mix		
Determine Density Coring Frequency/Location	RCE(3)	RCE(3)
Direct & Witness Coring & Transport to QC Lab	RCE(3)	RCE(3)
Obtain Core Samples & Prepare Samples at the QC Lab	CONTR	CONTR
Run Density Testing on Cores	RCE(3)	RCE(3)
Record Density Testing Measurements on Cores	RCE(3)	RCE(3)
Report Density Testing Results on Cores	CONTR(1)	CONTR(1)
Revisions		
Adjust Production to Maintain JMF Targets	CONTR	CONTR
Report Plant Adjustments	CONTR(1)	CONTR(1)
Approve Revisions to JMF Targets	DME	DME
Shut Down Production when Required	CONTR	CONTR

NOTES:

(1) Must be done by Certified Level I HMA Technician
(2) Must be done by Certified Level II HMA Technician
(3) Must be done by Certified HMA Sampler
(4) Must be done by Certified Aggregate Sampler~~.~~ Technician
(5) Must be done by Certified Aggregate~~.~~ Technician

ABBREVIATIONS:

CPI = Certified Plant Inspection
QMA = Quality Mgmt. of Asphalt
RCE = Project Engineer
CONTR = Contractor
DME = District Materials
CTRL = Central Materials

TESTING
CORES

TESTING CORES

Cores drilled from the roadway are tested the same way as gyratory specimens. The Agency Inspector selects the locations and directs and witnesses the drilling of the cores. If a core appears to be too thin or too thick, it should be measured and if it is out of spec a replacement core drilled at a nearby location. If the core is damaged a replacement core should be drilled from the same location. The cores need to be carefully handled and transported to avoid any distortion or damage that may affect test results.

The Agency Inspector will test the cores individually in the contractor's lab by obtaining the required three weights for each core before testing the next core. A copy of the results will be provided to the contractor's certified technician to report on the Daily Plant Report. Sometimes cores must have lower lifts trimmed off by the contractor before testing. Cores should be measured, surface dried and examined for damage again before being tested. At least once per project a set of cores needs to be submitted to the District Lab as Independent Assurance.

Flexible Paving Mixture Core Sampling and Testing Worksheet (version 1.02)

Plant Report Number: 1

Project Number: NHS-6-3(41)--12-77 **Contract ID Number:** 77-0006-41 **Mix Design Number:** ABD5-1005

Lift: Surface **Intended Thickness:** 2.000 **Field Voids Limits** 3.5 - 8.5

Date Laid: 10/21/2013 **Date Tested:** 10/22/2013 **Sampled By:** John/(Anderson) **(Witness)**

	Core # 1	Core # 2	Core # 3	Core # 4	Core # 5	Core # 6	Core # 7	Core # 8	*Core # 9 *As needed	*Core # 10	*Core # 11	*Core # 12
Lane:	S\W Pass	S\W Pass	S\W Pass	S\W Pass	S\W Pass	S\W Pass	S\W Pass	S\W Pass				
Station:	2+42	34+50	67+55	114+02	155+897	185+73	195+87	259+10				
CL Offset:	3.10	9.10	9.00	4.50	5.80	6.10	7.40	2.00				
Dry Weight:												
Weight in Water:												
SSD Weight:												
Thickness:												

70% of Intended Thickness = 1.4 **150% of Intended Thickness =** 3

Comments:

Tested By: **Contractor:**

Flexible Paving Mixture Joint Core Sampling and Testing Worksheet (version 1.02)

Plant Report Number: 1

Project Number: NHS-6-3(41)--12-77 **Contract ID Number:** 77-0006-41 **Mix Design Number:** ABD5-1005

*Only required on Surface Mainline

Lift: Surface **Intended Thickness:** 2.00

Date Laid: 10/21/2013 **Date Tested:** 10/22/2013 **Sampled By:** John/(Anderson) (Witness)

	Joint Core # 1	Joint Core # 2	Joint Core # 3
Sublot Length (From Random Core Sheet)			
Joint ID:	2L-Centerline	2L-Centerline	2L-Centerline
Station:			
Joint Geometry (Butt/Wedge):	Butt	Butt	Butt
Dry Weight:			
Weight in Water:			
SSD Weight:			
Thickness:			

70% of Intended Thickness = 1.4

150% of Intended Thickness = 3

Comments:

Tested By: Contractor:

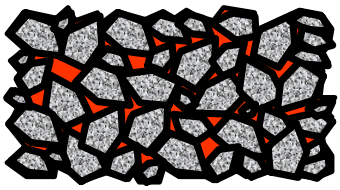
Bulk Specific Gravity of Compacted Bituminous Mixtures (I.M. 321)

- **Purpose**
  - Determine Gmb and density of compacted specimens
  - Used in volumetric analysis
- Apparatus
  - Balance
  - Oven
  - Sample Basket
  - Water Bath

BSG of Compacted HMA

- **Binder mixed with agg. and compacted into sample**

$$G_{mb} = \frac{\text{Mass agg. and Binder}}{\text{Vol. agg., Binder, air voids}}$$



Testing

- **Mass of dry sample**
- **Mass under water**
- **Mass saturated surface dry (SSD)**

Apparatus Preparation (I.M. 321)

- Hang the basket from the bottom of the scale
- Fill the container with 77°F water
- Check that the scale balances to zero
- Maintain the water level above the basket. (If it falls below, it will change the scale balance and your final answer.)
- Check that the basket does not touch the side or the bottom of the bucket

Sample Preparation (I.M. 321)

- Compacted specimens (SGC) or field cores
- Field cores must be surface dried

Test Procedure (I.M. 321)

- Cool to room temp and record mass in air to 0.1g (W_1)
- Place in basket, immerse in water at 77±5°C until balance stabilizes, record mass in water to 0.1g (W_2)
- Remove and damp dry (SSD) by blotting with a damp towel, then immediately record SSD mass to 0.1g (W_3)

Testing

Obtain mass of dry compacted sample

Testing

Obtain mass of specimen at SSD

Calculations

- $G_{mb} = W_1 / (W_3 - W_2)$

  Where:

  W_1 = mass of dry sample

  W_2 = mass of sample under water

  W_3 = mass of SSD sample

Calculations (I.M. 321)

- Bulk Specific Gravity, Gmb = $W_1/(W_3 - W_2)$
- Density = Gmb×$density_{water}$
- Report all gravities to 0.001

METHOD OF TEST FOR COMPACTED DENSITY OF ASPHALT MIXTURES (DISPLACEMENT METHOD)

SCOPE

This IM provides the method of test used in determining the bulk specific gravity (G_{mb}), bulk density, of laboratory-compacted specimens of asphalt or cores takes from compacted asphalt pavements.

APPARATUS

- A balance having a capacity of 5000 grams or more and accurate to 0.5 gram.
- Water container of sufficient size to allow a submerged sample to not touch the sides or bottom.
- Suspension apparatus (sample holder) – “wire suspending the container shall be the smallest practical size to minimize any possible effects of a variable immersed length. The suspension apparatus shall be constructed to enable the container to be immersed to a depth sufficient to cover it and the test sample during weighing. Care should be taken to ensure no trapped air bubbles exist under the specimen” (AASHTO T166-00).
- Spatula or putty knife
- Clean cloth

Balance, Sample Holder, and Water Container

PROCEDURE

SAMPLE PREPARATION

Field Cores

1. Allow the core to attain laboratory room temperature prior to testing. Cores stored in refrigerated units must be removed and allowed to stand at least 2 hours at room temperature prior to testing. Under no circumstances shall the cores be submerged in water prior to testing.

2. Clean off all loose particles, base materials, and prime oils that are stuck to the sample. The portion of the sample that needs to be cleaned may be lightly warmed and scraped with a putty knife.

3. If water was used in cutting the sample, the specimen shall be surface-dried before testing.

Laboratory Compacted Specimens

1. Cool lab-compacted specimens to laboratory room temperature before testing.

2. Clean off all loose particles that are stuck to the specimen.

TEST PROCEDURE FOR DENSITY

1. Fill the water container with water at approximately 77°F to a depth sufficient to ensure that the sample holder and sample are completely submerged during testing.

2. Connect the wire to the balance at the point provided on the balance.

3. Connect the holder to the wire and place in the water bath filled with water and tare the balance.

4. Weigh the sample in air (W_1).

5. Weigh the suspended sample completely submerged in water targeted at 77° ± 5°F (W_2). The reading must be taken when the balance stabilizes.

> **NOTE:** The balance will normally be considered to have stabilized when the weight reading doesn't change by more than 0.1 gram over a 10 to 30 second time span.

6. Remove the sample from the water and immediately, with a damp cloth, blot the free water from the surface of the sample. Then, immediately weigh the sample again in air (W_3).

> **NOTE:** Care should be taken not to rub any particles from the edges or corners when blotting the free water.

7. Calculate the G_{mb} bulk density and report the result to three decimal places.

CALCULATIONS

The calculation for determining G_{mb} is as follows:

$$G_{mb} = \frac{W_1}{W_3 - W_2}$$